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Source : MNHN, Paris

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New and little-known Bryozoa from Antarctica and the southwest Atlantic

by P. J. HAYWARD and J. S. RYLAND

Abstract. — Eight species of cheilostome Bryozoa are described from Antarctica and the magellanic southwest Atlantic. Five new species are recognized, in the genera *Escharoides*, *Cellarinella* and *Inversiula*. *Cellarinella roydsi* Rogick is regarded as a junior synonym of *C. watersi* Calvet. WATERS' (1904) records of *Bifaxaria denticulata* and *Bifaxaria rustica* from the Bellingshausen Sea are referred to *Cellarinella virgula* sp. nov.

Résumé. — Les auteurs décrivent huit espèces de Bryozoaires Cheilostomes provenant de l'Antarctique et de la région magellanique du sud-ouest atlantique. Cinq nouvelles espèces, appartenant aux genres *Escharoides*, *Cellarinella* et *Inversiula*, y sont reconnues. *Cellarinella roydsi* est considérée comme étant un « junior synonym » de *C. watersi* Calvet. Les signalisations de WATERS (1904) concernant la présence en mer de Bellingshausen de *Bifaxaria denticulata* et de *Bifaxaria rustica* se rapportent à une nouvelle espèce, *Cellarinella virgula* n. sp.

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The cheilostome Bryozoa of Antarctica and adjacent subantarctic regions are presently attracting renewed interest from marine biologists and ecologists after a considerable period of neglect. Bryozoan faunas of these regions are known to be rich, with high levels of endemicity (ROGICK, 1965), and in some areas of the Antarctic shelf seas comprise a significant proportion of the sessile benthos (BULLIVANT, 1967). However, many of the species described by earlier authors (e.g., JULLIEN, 1888; CALVET 1904, 1909; WATERS, 1904) have never been adequately redescribed and remain poorly characterized, and in Antarctic coastal waters in particular the fauna includes a high proportion of undescribed species. In systematic research on the Antarctic Bryozoa it is important to re-examine type and original materials of previously described species, not least because scanning electron micrography now permits a more informed understanding of the skeletal morphological characters on which bryozoan taxonomy is largely based. The species descriptions given by earlier authors are frequently brief, and their illustrations are generally inadequate and do not help in distinguishing between closely similar species. Taxonomic precision is especially important in describing the faunas of western Antarctica and the Scotia Arc, which to some extent seem to constitute a transitional zone between the magellanic and Antarctic zoogeographical realms. Very few bryozoan species have geographical distributions which encompass both realms, and apparently geographically widespread species most often prove to comprise two or more superficially similar taxa.

In this present account eight species of cheilostome Bryozoa are described from the collections of Antarctic Bryozoa accumulated by the Institute of Oceanographic Sciences,

Source : MNHN, Paris

Deacon Laboratory, Wormley, England. Three new species are described in the endemic Antarctic genus *Cellarinella*. The comparatively well-known *Cellarinella roydsi* Rogick is shown to be a junior synonym of the rarely reported *C. watersi* Calvet, following re-examination of CALVET's holotype specimen. Two species of *Bifaxaria* described by WATERS (1904) from the Bellingshausen Sea are referred to *Cellarinella virgula* sp. nov. *Schizoporella pellucidula* Calvet is shown to belong to the southern hemisphere genus *Hippomonavella*. A new species of *Escharoides* is described from South Georgia, and *Inversiula nutrix* Jullien, an endemic magellanic species which ranges south to the Antarctic Peninsula, is distinguished from a second species which is perhaps limited to the Patagonian Shelf. All I.O.S. specimens listed have been deposited in the Bryozoa Section, Department of Zoology, the Natural History Museum, London. Registration numbers of type specimens are indicated by the prefixes BMNH (Natural History Museum, London), or MNHN (Muséum National d'Histoire Naturelle, Paris). Details of collecting stations are given hereafter.

DETAILS OF COLLECTING STATIONS

« Discovery » Stations

152 : 17.01.1927. Off South Georgia. 53°51.5′ S, 36°18.5′ W. 245 m.
160 : 07.02.1927. Near Shag Rocks. 53°43.6′ S, 40°57′ W. 177 m.
164 : 18.02.1927. Normanna Strait, South Orkneys. 24-36 m.
179 : 09.03.1927. Melchior Id., Schollaert Channel, Palmer Archipelago.
456 : 18.10.1930. Off Bouvet Island. 40-45 m.
1660 : 27.01.1936. Ross Sea. 74°46.4′ S, 178°23.4′ E. 351 m.
1948 : 04.01.1937. N. of Clarence & Elephant Is. 60°49.4′ S, 52°40′ W. 490-610 m.
WS25 : 17.12.1926. Undine Harbour, South Georgia. 18-27 m.
WS27 : 19.12.1926. Off South Georgia. 106-109 m.
WS33 : 21.12.1926. Off South Georgia. 130 m.
WS42 : 07.01.1927. Off South Georgia. 198 m.

« Terra Nova » Stations

314 : 23.02.1911. Off Inaccessible Id., McMurdo Sound, Ross Sea. 406-441 m.

Family EXOCHELLIDAE Bassler, 1935

Genus **ESCHAROIDES** Milne Edwards, 1836

Escharoides torquata sp. nov.
(Plate I, A-C)

MATERIAL. — Holotype : BMNH 1990.12.13.1, Discovery Stn. 152; paratype : BMNH 1990.12.13.2, Discovery Stn. 152.

DESCRIPTION

Colony forming a thick, encrusting, unilaminar sheet. Autozooids broadly oval to hexagonal, convex, separated by deep grooves; frontal wall thick, smooth and with a few fine

Source : MNHN, Paris

longitudinal corrugations, with well marked marginal pores. Proximal lip of aperture produced as a stout, angular, median mucro; its inner rim with an anvil-shaped median denticle. Four short, club-shaped, distal oral spines present in newly budded autozooids, two persisting in ovicelled autozooids. Avicularia abundant : typically one on each side of the mucro, slightly acute to frontal plane and directed laterally; others then develop, closely juxtaposed, around the whole periphery of the autozooid, forming a closed ring of avicularia with varying orientation; rostrum oval, slightly raised distally, 0.1-0.2 mm long, with complete crossbar. Ovicell about as wide as long, smooth surfaced, with a slight apertural lip. Large and capacious basal pore chambers present.

Measurements (mm)

	n	$\bar{x}$	s.d.
Autozooid length	20	1.15	± 0.10
Autozooid width	20	0.81	± 0.08

REMARKS

Escharoides torquata is distinguished from all other species of *Escharoides* by its remarkable battery of avicularia, and by the pronounced denticulation of the inner, proximal edge of the aperture. The material described here was collected from a single station off South Georgia.

Family CELLARINELLIDAE Moyano, 1970

Genus **CELLARINELLA** Waters, 1904

Cellarinella anomala sp. nov.
(Plate I, D; II, A-B)

MATERIAL. — Holotype : BMNH 1990.12.13.3, Discovery Stn. WS42; paratypes : BMNH 1990.12.13.4, Discovery Stn. WS42.

DESCRIPTION

Colony erect, with flat, curved or irregularly twisted branches, dividing irregularly to give broad lobes, or narrow strap-like rami; typically narrow at the base, rarely exceeding 6 mm wide, but tending to broaden abruptly to 20 mm or more, and then to divide into a number of unequal rami. Basal attachment unknown. Autozooid boundaries obliterated in earliest ontogeny by reticulate frontal calcification; the colony surface appearing uniform, regularly perforated by deep, angular pits, only the apertures marking the position of each autozooid. At the base of the colony all autozooid apertures are obscured by thick, uniformly reticulate calcification. Autozooid aperture wider than long, more or less semicircular, with a smooth, transverse proximal oral shelf; at the growing edge, before the completion of the aperture rim,

Source : MNHN, Paris

a broad distal oral shelf may be seen, but there is no internal avicularium. Most autozooids with a single frontal avicularium, proximal to aperture, the rostrum oval, slightly acute to frontal plane and directed proximo-laterally. In a minority of autozooids a second, larger avicularium may be present, lodged within the proximal edge of the aperture, transversely orientated, with a curved, sharply hooked rostrum. Ovicell longer than wide, imperforate, but becoming submerged in reticulate calcification; brooding autozooids may be recognised by a thickened, projecting, proximal apertural lip, which may incorporate, on one or both sides a small, distally directed avicularium, with hooked rostrum.

Measurements (mm)

	n	$\bar{x}$	s.d.
Aperture length	20	0.10	± 0.09
Aperture width	20	0.22	± 0.01
Frontal avic. length	20	0.14	± 0.008
Apertural avic. length	10	0.24	± 0.02

REMARKS

This species has some resemblance to *C. latilaminata* Moyano, which also lacks internal avicularia, and in which the brooding autozooids develop swollen apertural lips, incorporating one or two avicularia. *C. anomala* is distinguished from *C. latilaminata* in its shorter aperture, which does not develop the stout proximal umbo seen in the latter, in its smaller, more rounded frontal avicularia, and in the dimorphic apertural avicularia, which do not occur in *C. latilaminata*. The colony of *C. latilaminata* forms broad, folded sheets, quite unlike the branching form of *C. anomala*.

Cellarinella edita sp. nov.
(Plate II, C-D)

MATERIAL. — Holotype : BMNH 1990.12.13.5, National Antarctic Expedition, McMurdo Sound, Ross Sea, 1.5.1903; paratype : BMNH 1990.12.13.6, National Antarctic Expedition, McMurdo Sound, Ross Sea, 1.5.1903. Other material : Terra Nova Stn. 314, Discovery Stn. 1660.

DESCRIPTION

Colony attached by an encrusting base to hard substrata, developing a slender, irregularly branching, three-dimensional form, exceeding 80 mm high, with an equivalent horizontal spread. Basal part of colony slender, cylindrical and smooth, the branches dividing dichotomously, flattening and twisting distally, broadening to a maximum width of 5-6 mm. Autozooids arranged in up to ten alternating, longitudinal series on each face of the branch, with a single series along each branch edge; strongly convex, with indistinct boundaries apparent at the growing edge, the entire frontal surface of the colony consisting of continuous, reticulate calcification. Aperture large, initially more or less D-shaped, but becoming more nearly round as ontogenetic thickening of the calcification proceeds; proximal border with a smooth, convex oral shelf projecting into the aperture, not readily visible in later ontogeny as the aperture becomes more deeply immersed. Frequently, a stout, conical umbo projects

Source : MNHN, Paris

distally from the proximal border of the aperture. A single avicularium present proximo-lateral to the aperture, with rounded, proximo-laterally directed rostrum, supporting a semicircular mandible. No internal avicularium. Ovicell wider than long, at first very prominent, with a wide orifice opening above the aperture of the brooding autozooid, which develops a projecting, spout-like proximal lip to the aperture; eventually becoming immersed in reticulate calcification.

Measurements (mm)

	n	$\bar{x}$	s.d.
Aperture length	20	0.29	± 0.02
Aperture width	20	0.27	± 0.02
Avicularium length	20	0.19	± 0.01

REMARKS

The elongate, slender colony of *C. edita*, which is attached by encrusting autozooids to such hard substrata as pebbles and small stones, distinguishes it immediately from other species of *Cellarinella* present in the Ross Sea, which are attached by flexible rhizoids. The rounded frontal avicularium, and the lack of in internal oral avicularium are also distinct specific characteristics.

Cellarinella virgula sp. nov.

(Plate III, A-C)

Bifaxaria denticulata : WATERS, 1904 : 59, pl. 8, figs. 14a, b.
Bifaxaria rustica : WATERS, 1904 : 60, pl. 8, figs. 19a, b.

MATERIAL. — Holotype : BMNH 1990.12.13.7, Discovery Stn. 1948; paratypes : BMNH 1990.12.13.8, Discovery Stn. 1948. Other material : Discovery Stn. 1948. IRB 309, 565 ("*Bifaxaria denticulata*"), 348 ("*B. rustica*") : Exp. Ant. Belgica.

DESCRIPTION

Colony forming a slender rod, attached to the substratum by chitinous rhizoids, branching dichotomously at in frequent intervals; largest specimen 10 mm with a maximum width of 1 mm. Autozooids arranged in alternating, back to back pairs; slender, vase-like in profile with the proximal end distinctly tapered. Aperture terminal, irregularly pear-shaped in outline, with the proximal border comprising an obliquely-directed, curved, oral plate, and the edge of a horizontally orientated avicularium. Paired lateral suboral mucrones present, either or both with a small avicularium on the inner, median face, with oval, disto-laterally directed rostrum. In later ontogeny frontal thickening obscures both mucrones, the avicularia become indistinct, and the aperture deeply immersed and quite rounded.

REMARKS

Cellarinella virgula has a superficial resemblance to *C. laytoni* Rogick (plate III, B-D), which forms similar narrow, sparsely branched colonies. However, the larger autozooids of *C.*

Source : MNHN, Paris

laytoni are disposed in whorls of three to five, from early ontogeny, and never in the regular, alternating paired arrangement of *C. virgula*. *C. laytoni* is a much larger species than *C. virgula*, with very stout, prominent mucrones which give the colony a striking serrated profile; the suboral avicularia of *C. laytoni* are longer than those of *C. virgula*, with an elongate triangular mandible. WATERS' (1904) 'Belgica' specimens of "*Bifaxaria denticulata*" are clearly referable to *C. virgula*; each is slender, about 10 mm long and branched, the autozooids are arranged in alternating back-to-back pairs, with distinctly pear-shaped apertures within which the avicularia are clearly visible. The specimen of "*B. rustica*" is a dead, eroded fragment from the basal part of a colony; nevertheless, the characteristic arrangement of the autozooids and the morphology of the aperture are both distinct, and there is no doubt that it correctly belongs to *C. virgula*. The 'Discovery' specimens of this species all originate from a single station off the South Shetland Islands; the 'Belgica' material was collected from the Bellingshausen Sea.

Cellarinella watersi Calvet
(Fig. 1; plate IV, A-B)

Cellarinella watersi Calvet, 1909 : 33, pl. 3, figs. 8-10.
?not *Cellarinella watersi* : LIVINGSTONE, 1928 : 51, pl. 1, figs, 8, 10.
Cellarinella roydsi Rogick, 1956 : 265, pl. 16, figs. J, K; pl. 17, figs. A-I.
Cellarinella roydsi : MOYANO, 1965 : 12, pl. 3, figs. 2-6; pl. 4, fig. 4.

MATERIAL. — Holotype : MNHN 5649, Baie Biscoe. Exp. Charcot. Other material : Signy Island, British Antarctic Survey, 1985; Discovery Stn. 160.

REMARKS

CALVET's (1909) original description of *C. watersi* was brief; he made no reference to the oral plate or the apertural umbo, and did not see the internal avicularium. Consequently, it is not surprising that few authors have managed to recognise it again. LIVINGSTONE's (1928) description is unhelpful (although he does describe a mucro and an internal avicularium), and his figures show a species with a proximo-laterally directed suboral avicularium, rather similar to *C. rogickae* Moyano. ANDROSOVA (1972) merely listed *C. watersi*, remarking that she had numerous specimens "corresponding to the typical ones". ROGICK's (1956) detailed and well illustrated account of *C. roydsi* could not apply to CALVET's published description and figures. However, comparing the holotype specimen of *C. watersi* with 'Discovery' specimens of *C. roydsi* (previously checked with ROGICK's material) shows that there is no doubt that the two taxa are synonymous. CALVET's specimen (fig. 1) is an almost complete, dichotomously branched colony (one ramus is now missing), 25 mm high, 3 mm wide at the base, with the distal lobe 10 mm wide. The curved edge of the oral plate is visible within each autozooid aperture, as is the distal tip of the internal avicularium. Most autozooids have a pronounced apertural mucro, and in a few towards the basal part of the colony, twinned apertural avicularia (as illustrated by ROGICK, 1956) can be seen.

Cellarinella watersi has a wide geographical distribution within Antarctica, encompassing South Georgia, the Weddell Sea, the Palmer Archipelago and the coasts of Graham Land, and the Ross Sea.

Source : MNHN, Paris

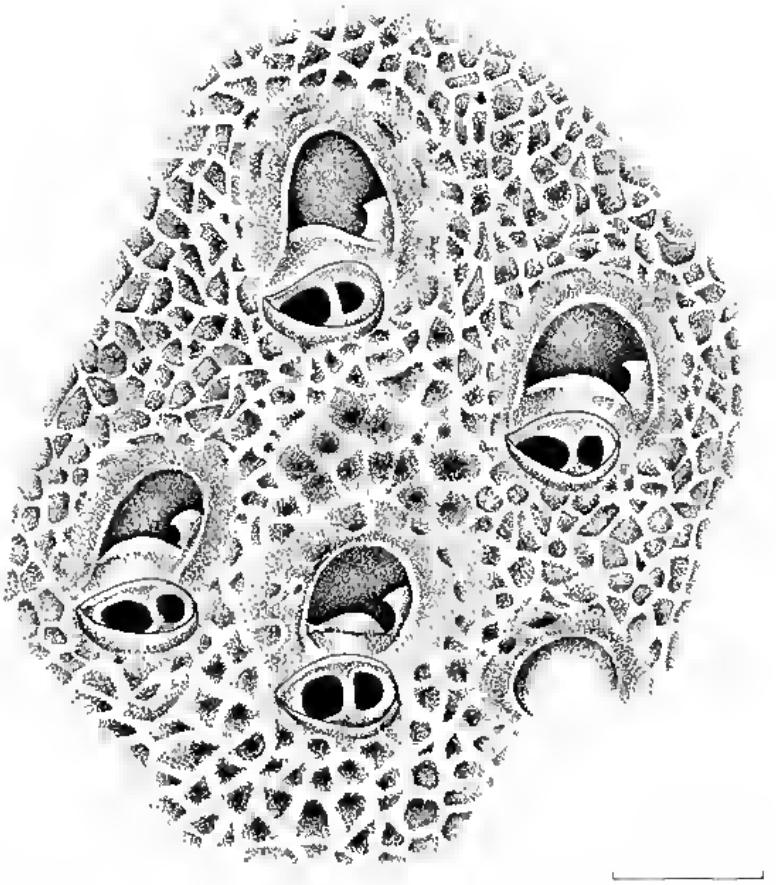

FIG. 1. — The holotype specimen of *Cellarinella watersi* Calvet. (Scale = 2 mm.)

Family INVERSIULIDAE Vigneaux, 1949

Genus **INVERSIULA** Jullien, 1888

Inversiula nutrix Jullien
(Plate IV, C-D)

Inversiula nutrix Jullien, 1888 : 44, pl. 4, fig. 8.
Inversiula nutrix : CALVET, 1909 : 22; MOYANO, 1972 : 106; HAYWARD, 1980 : 703

MATERIAL. — Holotype : MNHN 1534, Terre de Feu, Canal du Beagle, 1883. Other material : Discovery stns. 164, 179, 456. National Antarctic Expedition, Cape Adare; Operation Tabarin, serial nos. 1371, 1436, 1405, 1541, A441, 6220. British Grahamland Expedition, serial no. 1302, and 5.12.1935. British Antarctic Survey, Signy Id., Powell Rock, 15 m, and Harpagifer Gully, 8 m, 1986.

Source : MNHN, Paris

REMARKS

This distinctive species develops thick, encrusting sheets on hard substrata. Autozooids are 0.5-0.9 mm long, with the coarsely granular frontal wall densely and evenly perforated; the ascopore is situated close to the proximal border of the primary orifice, between the paired, columnar, suboral avicularia, it is more or less circular, with a finely denticulate rim.

Inversiula nutrix is distributed from Tierra del Fuego eastwards to Bouvet Island; it is abundant around the South Orkney and South Shetland Islands, and on the western coasts of the Antarctic Peninsula, where it occurs commonly in shore pools. However, LIVINGSTONE's (1928) record of it from Adelie Land is the only report of *I. nutrix* from elsewhere in Antarctica. CANU (1909, cited by CALVET (1909)) recorded *I. nutrix* from Tertiary deposits of Argentina, which suggests that it is an autochthonous species in the magellanic region.

All of the material listed above has been compared with JULLIEN's (1888) type specimen from Tierra del Fuego. One large colony from the southern Patagonian Shelf was found to differ significantly from all specimens of *I. nutrix*, and is here described as a new species.

Inversiula patagonica sp. nov.
(Plate V, A-B)

MATERIAL. — Holotype : BMNH reg. no. 1990.12.13.9, Discovery Stn. WS88.

DESCRIPTION

Colony forming a broad, multilaminar sheet. Autozooids oval to hexagonal, occasionally rather irregular; flat, or slightly convex, separated by distinct sutures. Frontal wall finely granular, with a single series of large marginal pores, and 30-40 much smaller, scattered, frontal pores. Primary orifice transversely oval, with a smooth rim; avicularia situated close to proximo-lateral edges of orifice, characteristic for genus. Ascopore just proximal to avicularia, transversely oval, or constricted medially and appearing reniform.

Measurements (mm)
(Means and standard deviation of 20 values)

	I. patagonica	*I. nutrix*	*I. nutrix*
	Holotype	Holotype	Signy Id.
Autozooid length	0.58 ± 0.06	0.61 ± 0.05	0.88 ± 0.06
Autozooid width	0.40 ± 0.07	0.47 ± 0.03	0.50 ± 0.05
Orifice length	0.08 ± 0.03	0.08 ± 0.004	0.13 ± 0.007
Orifice width	0.11 ± 0.006	0.10 ± 0.006	0.18 ± 0.005

Source : MNHN, Paris

Remarks

With ontogenetic thickening of frontal calcification, the distinction between the frontal and marginal pores of *I. patagonica* becomes less clear. However, comparison of autozooids at the growing edge with those of similar developmental stage in *I. nutrix* demonstrates the difference between the two species. In *I. nutrix*, the regularly punctured frontal wall appears almost reticulate. Antarctic specimens of *I. nutrix* (e.g., Signy Id., above) have larger autozooids, and correspondingly larger orifices, than are seen in Jullien's type, which is similar in size to the holotype specimen of *I. patagonica*. However, in its frontal wall morphology, the cotype of *I. nutrix* differs in no way from the Antarctic specimens listed here.

Family Smittinidae Levinsen, 1909

Genus **HIPPOMONAVELLA** Canu & Bassler *in* Bassler, 1934

Hippomonavella pellucidula (Calvet)
(Plate V, C-D)

Schizoporella pellucidula Calvet, 1904 : 27, pl. 2, figs. 3a, b.

Material. — Discovery Stns. WS25, WS27, WS33.

Description

Colony forming folded, brittle unilaminar sheets, loosely encrusting sponges, cnidarians and other biotic substrata ; or partly erect, forming irregular lobes ; maximum size and colony architecture unknown. Autozooids elongate, rectangular, rather flat, separated by distinct sutures. Primary orifice slightly wider than long ; anter transversely oval, poster with broadly concave edge, between conspicuous, bluntly pointed condyles. Orifice rim thickening in later ontogeny, but not developing a pronounced peristome. Oral spines generally absent, although a pair of inconspicuous spine bases present on a minority of autozooids. Frontal wall flat and smooth, bordered by a single series of relatively large pores. Vertical walls with small multiporous septula. Avicularia adventitious, dimorphic ; most frequently short, oval, 0.1 mm long, lateral suboral or sutural in position, the rostrum normal to frontal plane and proximally directed ; less frequently enlarged, with swollen cystid, 0.25 mm long, median suboral, rostrum slightly tapered distally, proximally directed. Both types of avicularia are budded from distal marginal pores of the autozooid. Ovicell hyperstomial, prominent, slightly wider than long, flattened frontally, closed by autozooid operculum ; ectooecium membranous frontally, entooecium smoothly calcified, with about 30 small, round pores.

Measurements (mm)

	n	$\bar{x}$	s.d.
Autozooid length	20	0.78	± 0.07
Autozooid width	20	0.38	± 0.07
Orifice length	20	0.14	± 0.008
Orifice width	20	0.17	± 0.009

Source : MNHN, Paris

Remarks

The type species of *Hippomonavella* Canu and Bassler, *Lepralia praeclara* MacGillivray, was originally described from Miocene deposits of Victoria (MacGillivray, 1895), and reported from the Recent fauna of South Australia by Wass and Yoo (1983). Gordon (1984, 1989) describes two further species from the Kermadec Islands and New Zealand. Colonies of *H. flexuosa* (Hutton) appear to adopt a very similar habit to those of *H. pellucidula*, and the autozooidal morphology of all of these species is remarkably similar. *H. pellucidula* was described by Calvet (1904) from specimens collected off South Georgia, from where all of the present specimens originate. It has not been reported again since Calvet's original account.

Acknowledgements

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Source : MNHN, Paris

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Source : MNHN, Paris

PLATE I

A-C : *Escharoides torquata* sp. n. : A, orifice, × 165; B, autozooids with numerous marginal avicularia, × 35; C, an ovicelled autozooid, × 70.
D : *Cellarinella anomala* sp. n., ovicelled autozooids at the growing edge, × 33.

Source : MNHN, Paris

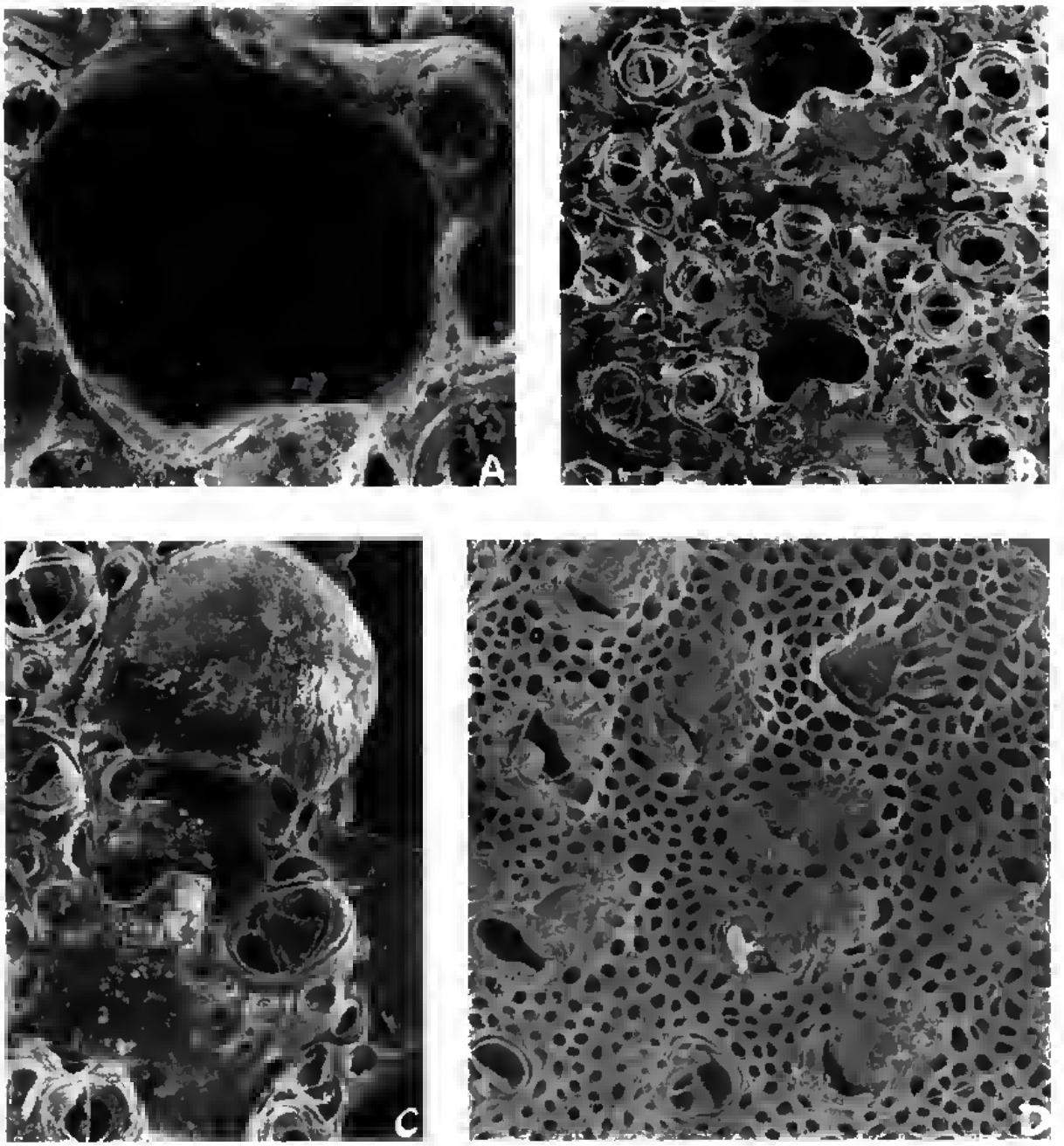

PLATE I

Source : MNHN, Paris

PLATE II

A-B : *Cellarinella anomala* sp. n. : A, autozooids with frontal avicularia, × 50; B, two autozooids with apertural avicularia, × 70.
C-D : *Cellarinella edita* sp. n. : C, group of autozooids, × 50; D, ovicelled autozooids, × 32.

Source : MNHN, Paris

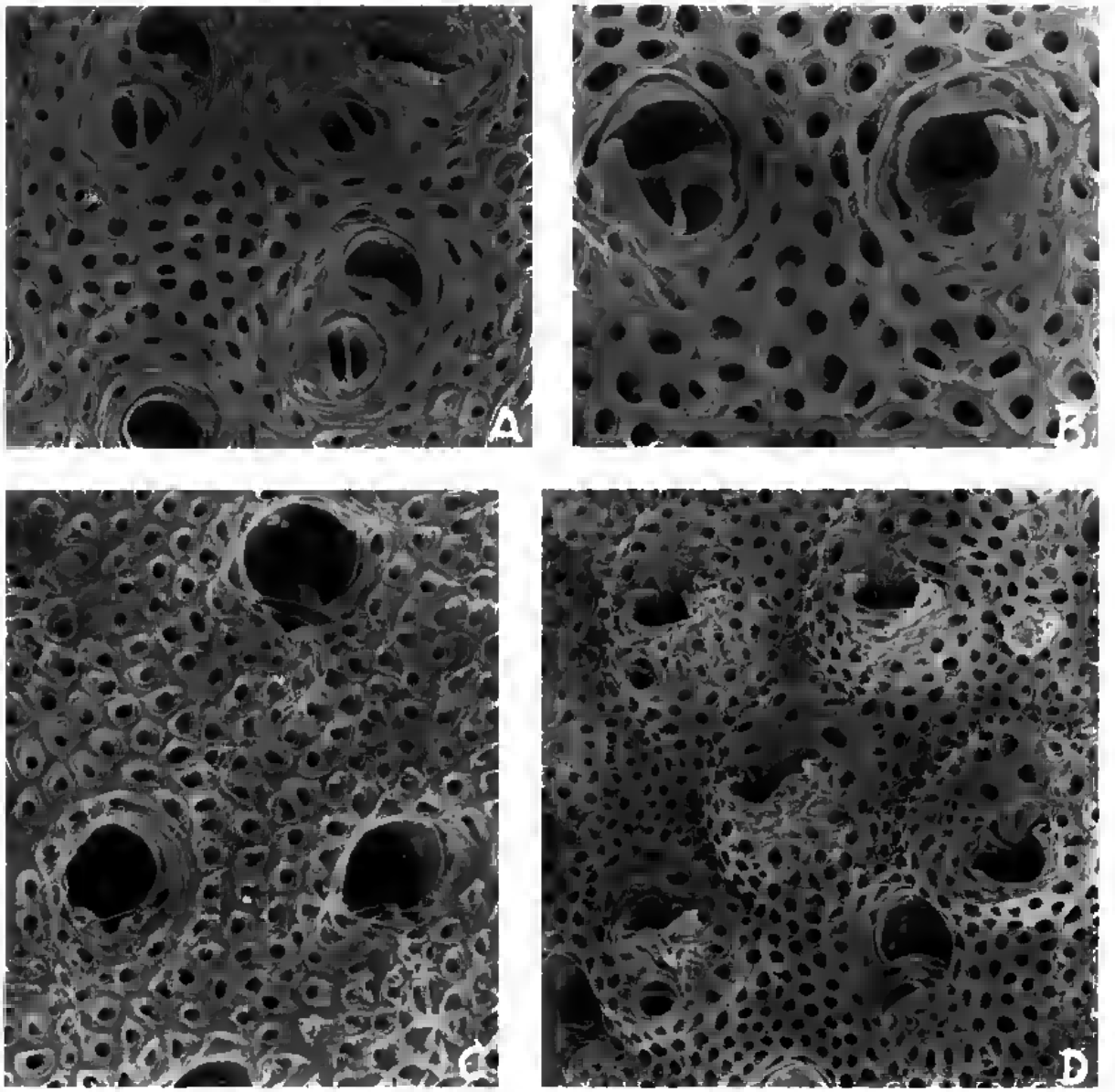

PLATE II

Source : MNHN, Paris

PLATE III

A : *Cellarinella virgula* sp. n., part of a branch, showing the alternating pairs of autozooids, × 60.
B : *Cellarinella laytoni* Rogick, tip of a branch, with autozooids in triple whorls, × 35.
C : *Cellarinella virgula* sp. n., autozooids in apertural view, × 80.
D : *Cellarinella laytoni* Rogick, an autozooid in apertural view, × 130.

Source : MNHN, Paris

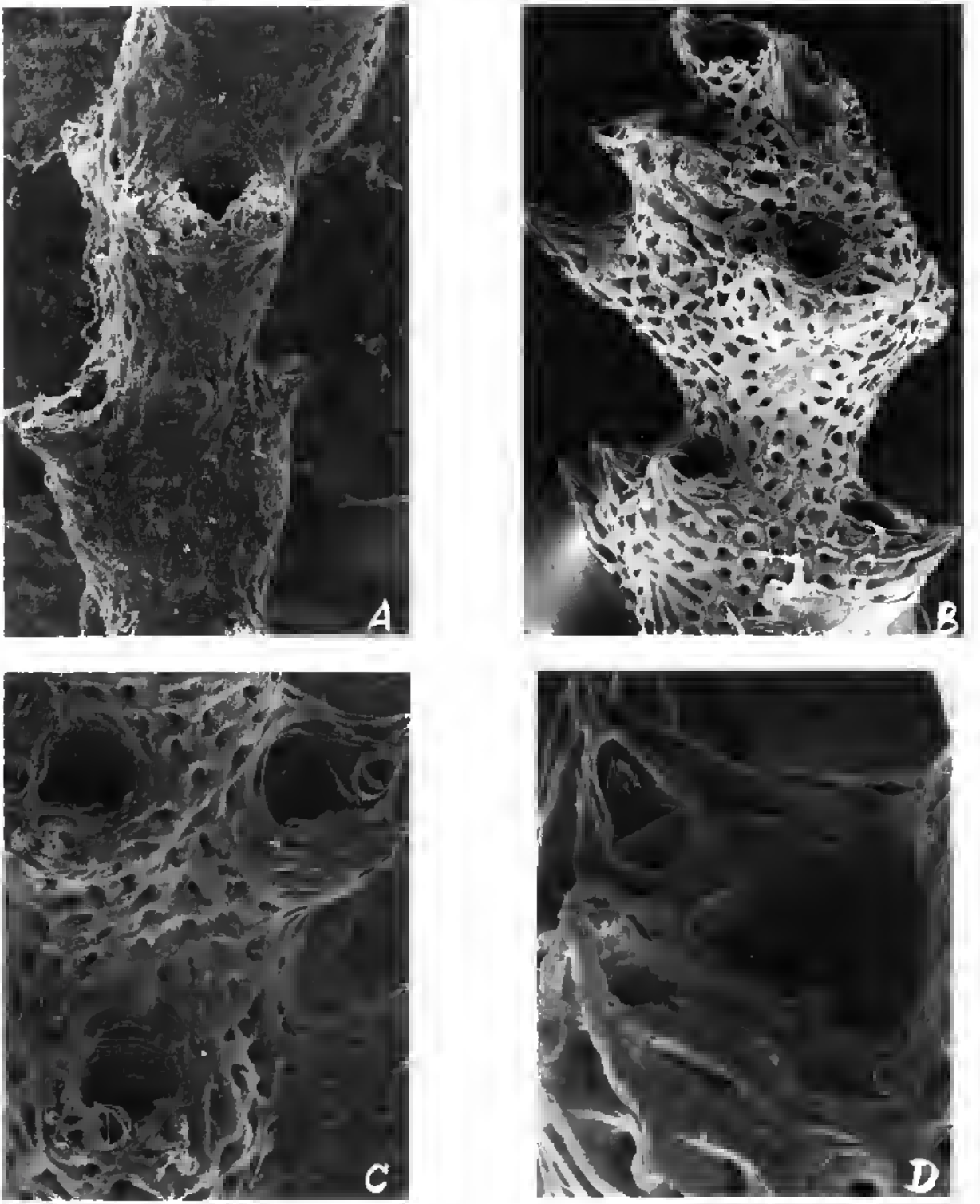

PLATE III

Source : MNHN, Paris

PLATE IV

A-B : *Cellarinella watersi* Calvet : A, frontal view of autozooids to show the apertural mucro, and paired and single avicularia, × 50; B, oblique view to show apertural and internal avicularia, × 40.
C-D : *Inversiula nutrix* Jullien : C, group of fully calcified autozooids, × 50; D, autozooids at the growing edge, × 50.

Source : MNHN, Paris

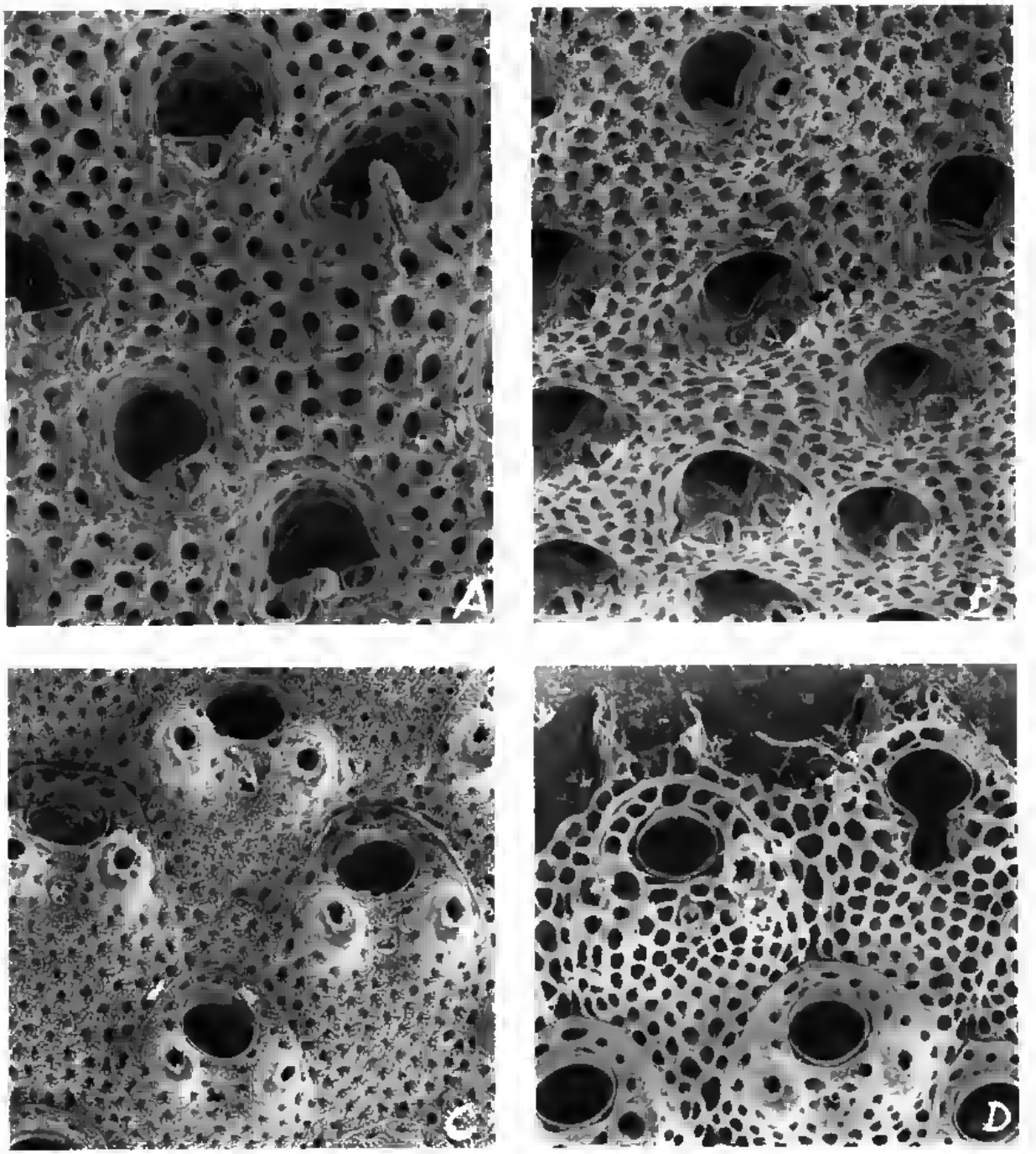

PLATE IV

Source : MNHN, Paris

PLATE V

A-B : *Inversiula patagonica* sp. nov., A, group of fully calcified autozooids, × 120; B, autozooids at the growing edge, × 90.

C-D : *Hippomonavella pellucidula* (Calvet) : C, group of autozooids, with ovicell and two types of avicularia, × 60; D, the primary orifice, × 270.

Source : MNHN, Paris

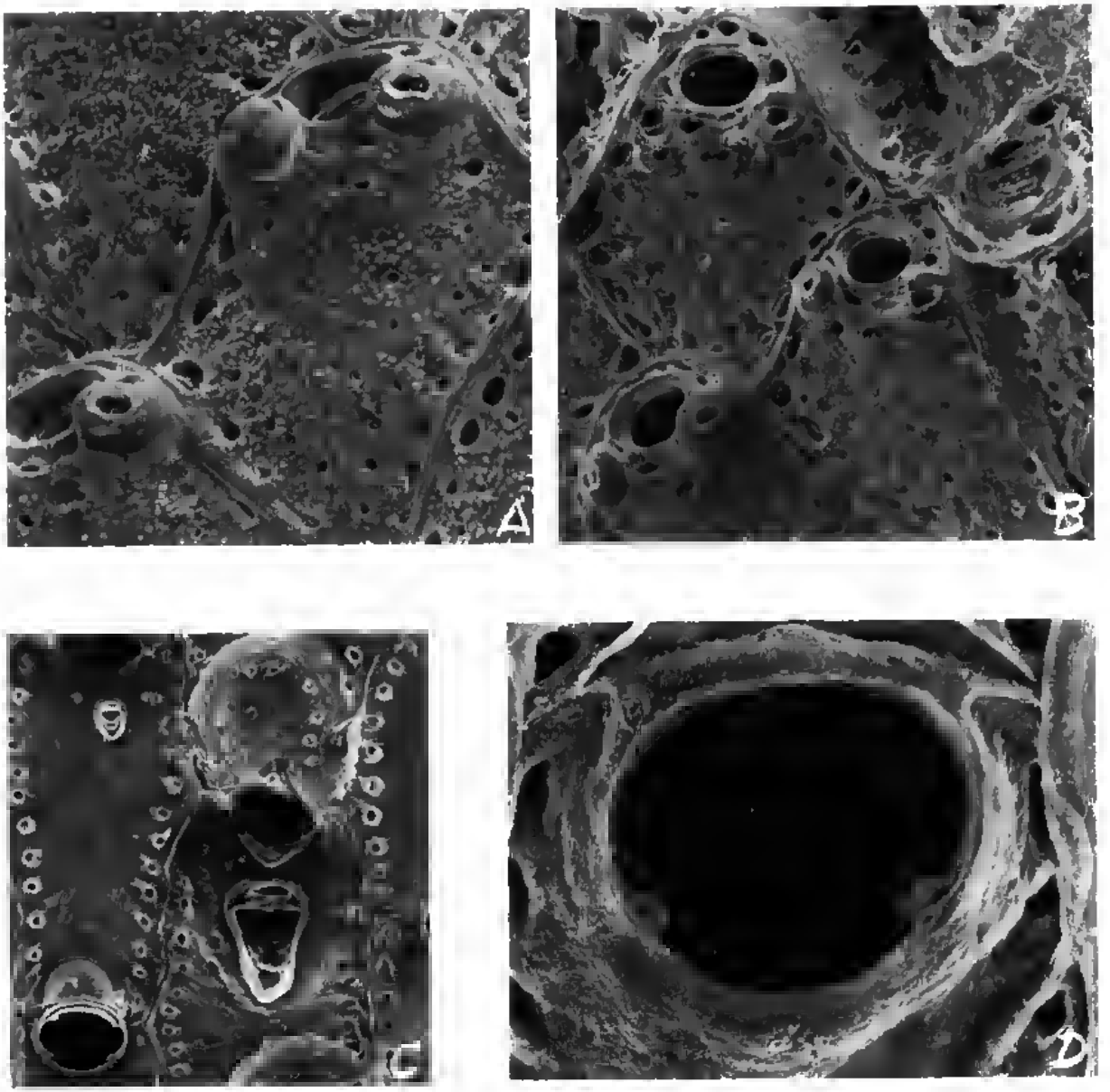

PLATE V

Source : MNHN, Paris

Source : MNHN, Paris

Bull. Mus. natl. Hist. nat., Paris, 4e sér., **13**, 1991,
section A, nos 3-4 : 263-281.

Taxonomy of tropical West African bivalves III. Four new species of Condylocardiidae from the continental shelf

by Carmen SALAS and Rudo VON COSEL

Abstract. — *Condylocardia boucheti* n. sp., from Mauritania, *C. angolensis* n. sp., *C. ameliae* n. sp. and *Carditopsis gofasi* n. sp., from Angola, are described. Incubating juveniles have been found in *Condylocardia boucheti, C. ameliae* and *Carditopsis gofasi.*

Résumé. — *Condylocardia boucheti* n. sp., de Mauritanie, *C. angolensis* n. sp., *C. ameliae* n. sp., *Carditopsis gofasi* n. sp., de l'Angola, sont décrites. L'incubation des jeunes a été constatée chez *Condylocardia boucheti, C. ameliae* et *Carditopsis gofasi*

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This paper is the continuation of a previous contribution, where four new species of *Condylocardia* from the Cape Verde Islands were described (SALAS and ROLÁN, 1990). The species from the West African mainland coast are now considered. Two species of Condylocardiidae are hitherto described from this area : *Carditopsis dartevellei* Nicklès, 1952 and *Cuna gambiensis* Nicklès, 1955. One South African species, *Carditella capensis* Smith, 1885, has been reported from Angola (Baia dos Tigres) by THIELE and JAECKEL (1931 : 213) and found again in our material from the same locality (1 specimen collected alive, leg. GOFAS, 1986). Four other species, three from Angola and one from Mauritania, are described herein.

Condylocardia boucheti n. sp.

(Fig. 1-8)

TYPE MATERIAL : Holotype MNHN (1.4 mm length × 1.25 mm height), shell with two incubating juveniles in protoconch stages inside; leg. BOUCHET, May 1983.

TYPE LOCALITY : Baie de l'Étoile (21° N), Mauritania.

DESCRIPTION

Shell minute, subtrigonal, slightly longer than high, thick and solid, very inflated. Beaks slightly behind the vertical midline. Surface with 10 broad and prominent radial ribs, with

Source : MNHN, Paris

interspaces slightly narrower than the ribs. There are also fine and concentric striae, forming small knobs and incisions on the radial ribs, especially on the marginal part of the valves. Lunule and escutcheon long and rather broad, delimited by the first and last radial rib. Protoconch large in relation to the adult shell, prominent, with numerous weak, irregular, radial ribs, some of them bifurcating. The protoconch is separated from the teleoconch by a broad and well-defined rim.

Periostracum very thin and colourless, persistent mostly in the interspaces of the radial ribs and the marginal part of the valves. Inner margin denticulate, reflecting the external sculpture. Small internal ligament, in oval resilium.

Hinge broad with spondyliform margin. Right valve with two cardinals, the anterior one a prominent tubercle next to the lower margin of the cardinal area; the posterior one short and somewhat trigonal, not reaching the lower margin; one anterior and one posterior lateral, equivalent in size. Left valve with three cardinals, the anterior one (apparently broken) oblique, not reaching the upper margin of the cardinal area and distally pointing to the lateral, the second cardinal short and trigonal, not reaching the lower margin of the hinge; the posterior cardinal oblique, somewhat prominent, reaching close to the lower margin of the cardinal are and distally pointing to the lateral; one anterior and one posterior lateral, equivalent in size.

Two oval and ill-defined adductor muscle scars beneath the distal part of lateral teeth. Pallial line entire and ill-defined.

Outside whitish with light brownish areas. Inside dull whitish and brownish, according to external colouration, which is showing through. The incubated protoconchs are white.

DISTRIBUTION : Only known from Mauritania.

MATERIAL EXAMINED : The holotype.

BIOTOPE : Unknown; the specimen was found in seagrass bed and mud, from the intertidal zone.

DERIVATIO NOMINIS : The species is dedicated to our colleague Philippe BOUCHET, who collected the holotype.

REMARKS

This species resembles superficially *Condylocardia carditoides* (Salas & Rolán, 1990) from Cape Verde Islands, but this latter is somewhat higher and has 11-14 ribs instead of 10. The protoconchs of both species are rather similar. The hinge plate of *C. boucheti* has a broader, more spondyliform central part.

The presence of two incubating juveniles inside the shell proves that it is adult despite its very small size.

Source : MNHN, Paris

Condylocardia angolensis n. sp.
(Fig. 9-24)

TYPE MATERIAL : Holotype MNHN, left valve (1.8 mm length × 1.6 mm height). Paratype : MNHN, one shell and one right valve, Lucira (Sta. Marta); two right valves, Lucira (Bissonga); MNCN, 1 right valve and one left valve, Lucira (Sta. Marta); IICT, 1 right valve and 1 left valve, Lucira (Sta. Marta); all leg GOFAS, 1981-86.

TYPE LOCALITY : Bay of Lucira (Bissonga), Namibe province, Angola, 10-20 m, in maerl.

DESCRIPTION

Shell minute, 1.8-2.3 mm long, obliquely oval-subtrigonal, longer than high, inflated, rather thick and solid. Beaks in front of the vertical midline. Surface with 14-15 strong, elevated, rounded radial ribs with narrow, but well marked interspaces crossed by a concentric sculpture. The latter consists of very thin lamellae in the interspaces of the ribs and weak constrictions on the ribs themselves, giving them a somewhat nodose appearance. Lunule and escutcheon very small and ill-defined. Embryonic shell with protoconch I and protoconch II, separated by a strong rim. Protoconch I smaller, with concentric, irregular and somewhat deep furrows; protoconch II rather large, with prominent, narrow, concentric ridges crossed by less apparent radial ridges, giving a nodular appearance. The protoconch is separated from the teleoconch by a prominent rim.

Periostracum very thin and colourless, persistent only in the interspaces of the ribs. Inner margin denticulate according to the external ribs. Ligament entirely internal, in a central, somewhat subtrigonal resilifer.

Hinge broad, with spondyliform hinge margin, slightly different in small (juvenile) and large (adult) specimens. In small sizes : Right valve with three cardinals; the two anterior ones fused proximally forming a hook and reaching distally the lower margin of the cardinal area; the posterior cardinal short and trigonal, not reaching the lower margin; one anterior and one posterior lateral, the anterior one stronger. Left valve with three cardinals, the anterior one prominent, oblique, not reaching the upper margin of the cardinal area and distally pointing to the lateral; the second cardinal short and trigonal, not reaching the lower margin of the hinge; the posterior cardinal oblique, somewhat prominent, not reaching the lower margin of the cardinal area and distally pointing to the lateral. In large size : Right valve with the posterior cardinal merged to the posterior dorsal margin of the shell, the two anterior cardinals as above. Left valve with the anterior cardinal reaching the upper margin of the cardinal area, the second cardinal enlarged and nearly reaching the lower margin of the cardinal area; the posterior cardinal completely merged to the posterior dorsal margin of the shell; one anterior and one stronger posterior lateral.

Anterior and posterior dorsal margins with minute crenulations. Two suboval ill-defined adductor muscle scars beneath the distal part of the lateral teeth. Pallial line entire and ill-defined.

Outside white, with small light brown spots or irregular zones. Inside white, with external colouration showing through.

Source : MNHN, Paris

DISTRIBUTION : Known only from a small area on the coast of southern Angola, from Bay of Lucira to Praia Amelia, Namibe province. No living specimens have yet been found.

MATERIAL EXAMINED : Bay of Lucira (Bissonga) : 1 lot with the holotype and 1 paratype; Bay of Lucira (Cesar) : 1 lot with 10 valves; Bay of Lucira (Santa Marta) : 1 lot with 1 shell and 10 valves, paratypes; Praia Amelia, 2 right valves and 1 left valve : all leg. GOFAS, 1983-86.

BIOTOPE : Unknown. The shells and valves were found in mixed and coarse sand with shell debris and calcareous algae, offshore from 10 to 60 m, not common.

DERIVATIO NOMINIS : The species is named after Angola.

REMARKS

C. angolensis can only be compared with the capeverdian *C. carditoides* (Salas & Rolán, 1990), but is much more oval. The protoconch is divided in protoconch I and protoconch II in *C. angolensis* with its genuine concentric sculpture in both parts, it is simple and has a radial sculpture in *C. carditoides*. The hinge of juvenile *C. angolensis* is close to those of *C. verdensis* (Salas & Rolán, 1990) and *C. boucheti* n. sp.

Condylocardia ameliae n. sp.

(Fig. 25-32)

TYPE MATERIAL : Holotype MNHN : 1 shell (2.1 mm length × 1.6 mm height). Paratypes (all from the type locality) : MNHN, 5 shells; MNCN, 4 shells, 1 right valve and 1 left valve; IICT, 4 shells, 1 right valve and 1 left valve; all leg. GOFAS, July 1986.

TYPE LOCALITY : Praia Amelia, Namibe province, Angola, 40-60 m.

DESCRIPTION

Shell minute, 2.0-2.2 mm long, obliquely subtriangular, longer than high, inflated, rather thick and solid. Beaks opisthogyrate, on the vertical midline. Surface with 13-14 prominent, rounded radial ribs, all starting from the protoconch rim, with marked interspaces, slightly narrower than the ribs. Concentric sculpture of fine lamellae, more conspicuous in the interspaces. Lunule deep and well marked; escutcheon narrow and ill-defined. Embryonic shell with protoconch I and protoconch II delimited by a concentric rim. Protoconch I with an irregular sculpture of radial riblets and furrows; protoconch II nearly smooth, separated from the teleoconch by a well marked rim.

Periostracum thin, almost colourless, more conspicuous in the interspaces of the ribs and margins. Inner margins denticulate according to the external sculpture, which is reflected on the interior of the shell. Ligament small, internal, in subtrigonal and subcentral resilifer under the protoconch margin.

Hinge broad and prominent, with spondyliform central hinge plate. Right valve with two divergent anterior cardinals, fused proximally forming a hook, the foremost one elongated,

Source : MNHN, Paris

less prominent and distally pointing to the lateral, the other one triangular, very prominent and nearly vertical, reaching the lower margin, of the cardinal area. One small, triangular and very short posterior cardinal, not reaching the lower margin of the cardinal area. One anterior and one less apparent posterior lateral. Left valve with two divergent anterior cardinals, the first one very prominent, obliquely reaching the margins of the cardinal area and distally pointing to the lateral, the second one hardly prominent, narrower, vertical and nearly reaching the margins of the cardinal area; one prominent posterior cardinal, somewhat prolongated to reach the margins of the cardinal area and distally pointing to the lateral; one anterior and one posterior lateral, the former less apparent.

Two oval and hardly visible adductor muscle scars beneath the distal part of lateral teeth. Pallial line entire and ill-defined.

Outside white, light brownish or brown, with paler beaks. Inside with external colouration showing through.

DISTRIBUTION : Known only from Praia Amelia (Southern Angola).

MATERIAL EXAMINED : Southern Angola : Praia Amelia : 1 lot with 104 specimens or shells and 85 valves (included the type material), leg. GOFAS, July 1986.

BIOTOPE : The lot from Praia Amelia was found in mixed and coarse sand, offshore from 40-60 m.

DERIVATIO NOMINIS : The species is named after the the type locality.

REMARKS

This species resembles in outline *Carditopsis gofasi* n. sp., however it is smaller, longer than high and has a pointed posterior margin. All ribs start from the protoconch rim, whereas in *C. gofasi*, some ribs are bifurcating. The hinge of *C. ameliae* has a much narrower, spondyliform central hinge plate and somewhat longer laterals; in *C. gofasi*, the cardinals are much closer to each other and the hinge plate is not spondyliform.

A few specimens were opened and one of them found to contain 9 brooded juveniles in protoconch stage.

Carditopsis gofasi n. sp.
(Fig. 33-47)

TYPE MATERIAL : Holotype MNHN (2 mm length × 1.9 mm height). Paratypes (all from type locality) : MNHN, 5 specimens (1 with larval shells included); MNCN, 4 specimens; IICT, 4 specimens; all leg. GOFAS, 1981-86.

TYPE LOCALITY : Ilha de Luanda, Luanda province, Angola; 40-60 m, in shell sand.

DESCRIPTION

Shell very small, 2-4 mm long, rounded-subtrigonal, slightly higher than long or as high as long, rather inflated, thick and solid. Beaks close to the vertical midline. Surface with 14-17

Source : MNHN, Paris

prominent, rounded, radial ribs with very narrow but marked interspaces. Central ribs bifurcating along the vertical midline on the earlier part of the teleoconch. Interspaces with fine concentric lamellae, obsolete on the ribs. Lunule rather deep, escutcheon narrow, both ill-defined. Embryonic shell with both protoconch I and protoconch II delimited by a concentric rim. Protoconch I with strong, irregular radial ribs separated by deep furrows; protoconch II nearly smooth.

Periostracum very thin, nearly colourless, persistent only in the interspaces of the ribs and near the margins. Inner margin denticulate according to the external sculpture. Ligament small, internal, in subrounded and about central resilifer, just beneath the protoconch margin.

Hinge broad and prominent. Right valve with two divergent anterior cardinals, the foremost one elongate, less visible and merged to the posterior dorsal margin of the cardinal area, the second one very prominent and triangular; posterior cardinal not visible and completely merged to the posterior dorsal margin of the cardinal area. One anterior and one posterior lateral, the anterior one more prominent. Left valve with two divergent anterior cardinals, the foremost one very strong, prominent and reaching the margin of the protoconch, the other one very small and not reaching the margin of the protoconch. One vertical, elongate and not much apparent posterior cardinal. One anterior and one more prominent posterior lateral.

Anterior and posterior dorsal margins with minute crenulations. Two reniform to oval adductor muscle scars beneath the distal part of lateral teeth. Pallial line entire and ill-defined.

Outside whitish, white with brown on the anterior part or occasionally entirely brown. Inside white, with exterior colouration showing through.

DISTRIBUTION : Northern Angola (Ambrizete, Zaire province) to southern Angola (Lucira, Namibe province).

MATERIAL EXAMINED : **Northern Angola** : Ambrizete (Zaire province), box cores, 40-80 m : 5 lots (leg. GOFAS, MNHN); Cacuaco (Bengo province), 5-10 m : 2 lots (leg. GOFAS, MNHN), 1 lot (leg. ROLÁN); Ilha de Luanda (Luanda province), 40-60 m : the type material (holotype and paratypes), with living specimens and 3 other lots (MNHN), 1 lot (leg. ROLÁN); off Mussulo (Luanda province), 90-100 m : 4 lots (leg. GOFAS, MNHN), 1 lot (leg. ROLÁN); off Mussulo, 120 m, 1 lot (leg. GOFAS, MNHN). **Southern Angola** : Bay of Santa Maria (Benguela province) : 2 lots; Bay of Lucira (Namibe province) : 5 lots; all leg. GOFAS, 1981-86.

BIOTOPE : In fine, mixed or coarse sand, often with shell debris, from shallow water (5-10 m), but generally more offshore in 40-100 m, common

DERIVATIO NOMINIS : This species named after our colleague Serge GOFAS who dredged extensively on the coast of Angola and collected most material dealt with in this paper.

REMARKS

The new species is rather close in outline to *Carditopsis dartevellei* Nicklès, 1952, and *Condylocardia ameliae* n. sp., but in these, the middle ribs are never bifurcated. Moreover, the ribs in *C. dartevellei* are more prominent, with scales, and *C. ameliae* has fewer radial ribs. A dozen of the live collected specimens have been opened. Two of these, one from Ilha de Luanda (40-60 m) and the other from Bay of Lucira (Praia Cesar, 10 m), contained each 15 to

Source : MNHN, Paris

20 incubating juveniles in protoconch stage (fig. 42-47). This confirms the incubator character (WALLER, 1973) of the genus *Carditopsis*, which in this case develops a greater number of offspring than any West African *Condylocardia* we have seen.

Our orientation of valves is guided by the position of foot and gill filament in the examined specimens. The orientation of the shell of *Carditopsis dartevellei* given by NICKLÈS (1952) is reverse and deemed to be incorrect.

CONCLUDING REMARKS

Hinge characters of the three species *Carditopsis gofasi*, *Condylocardia ameliae* and *C. angolensis* are interpreted as increasingly neotenous. The large cardinal tooth in the left valve of *C. gofasi* is not essentially different from the cardinal tooth of *C. ameliae* but in this latter species, the cardinal tooth is not so large and is fused with the posterior lateral to form the genuine hook shaped structure of *Condylocardia*. In *C. angolensis* (or *C. bouchetî*), the hook-shaped structure is conspicuous and the cardinal is not obviously triangular. *Carditopsis* and *Condylocardia* are hence extremely closely related.

Museum abbreviations

MNHN : Muséum National d'Histoire Naturelle (Paris).
MNCN : Museo Nacional de Ciencias Naturales (Madrid).
IICT : Instituto de Investigação Cientifica Tropical (Centro de Zoologia) (Lisbon).

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We are indebted to Serge GOFAS, who collected and donated most material of the Angolan species, to Emilio ROLÁN who donated additional Angolan material and to Philippe BOUCHET, who contributed the Mauritanian species. We are grateful to S. GOFAS and P. BOUCHET for critically reading the manuscript. Gregorio Martin CABALLERO and Juan José Canca CUENCA operated for us the scanning electron microscope of the University of Málaga.

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Source : MNHN, Paris

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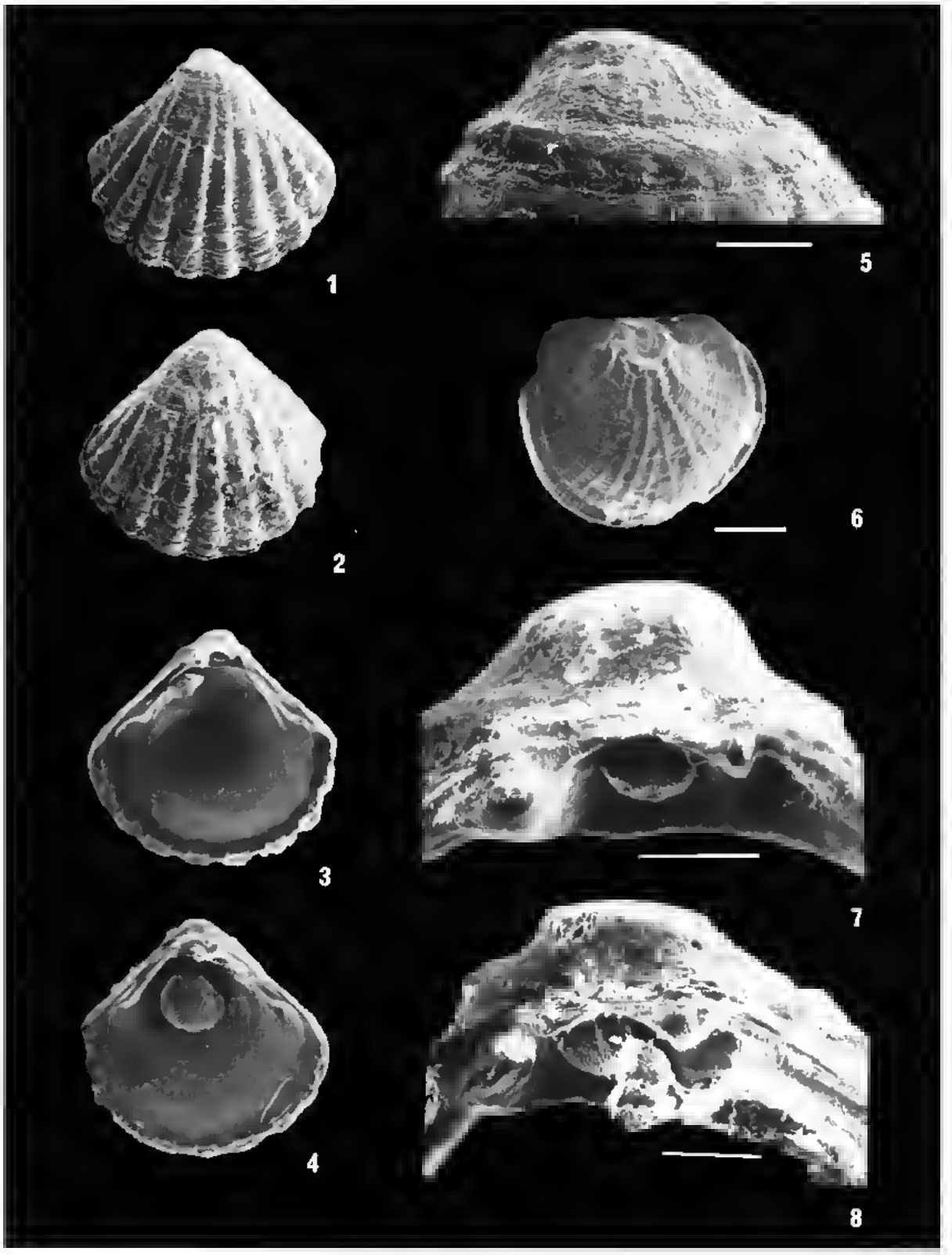
FIG. I-8. — *Condylocardia boucheti* n. sp. (holotype MNHN). Scale bars are 100 µm.

1. Exterior of right valve. Baie de l'Étoile. Actual length 1.4 mm.
2. Exterior of left valve.
3. Interior of right valve with incubating larval shells.
4. Interior of left valve with incubating larval shells.
5. Protoconch of right valve.
6. Incubating larval shell.
7. Cardinal area of right valve (fig. 3).
8. Cardinal area of left valve (fig. 4).

Source : MNHN, Paris

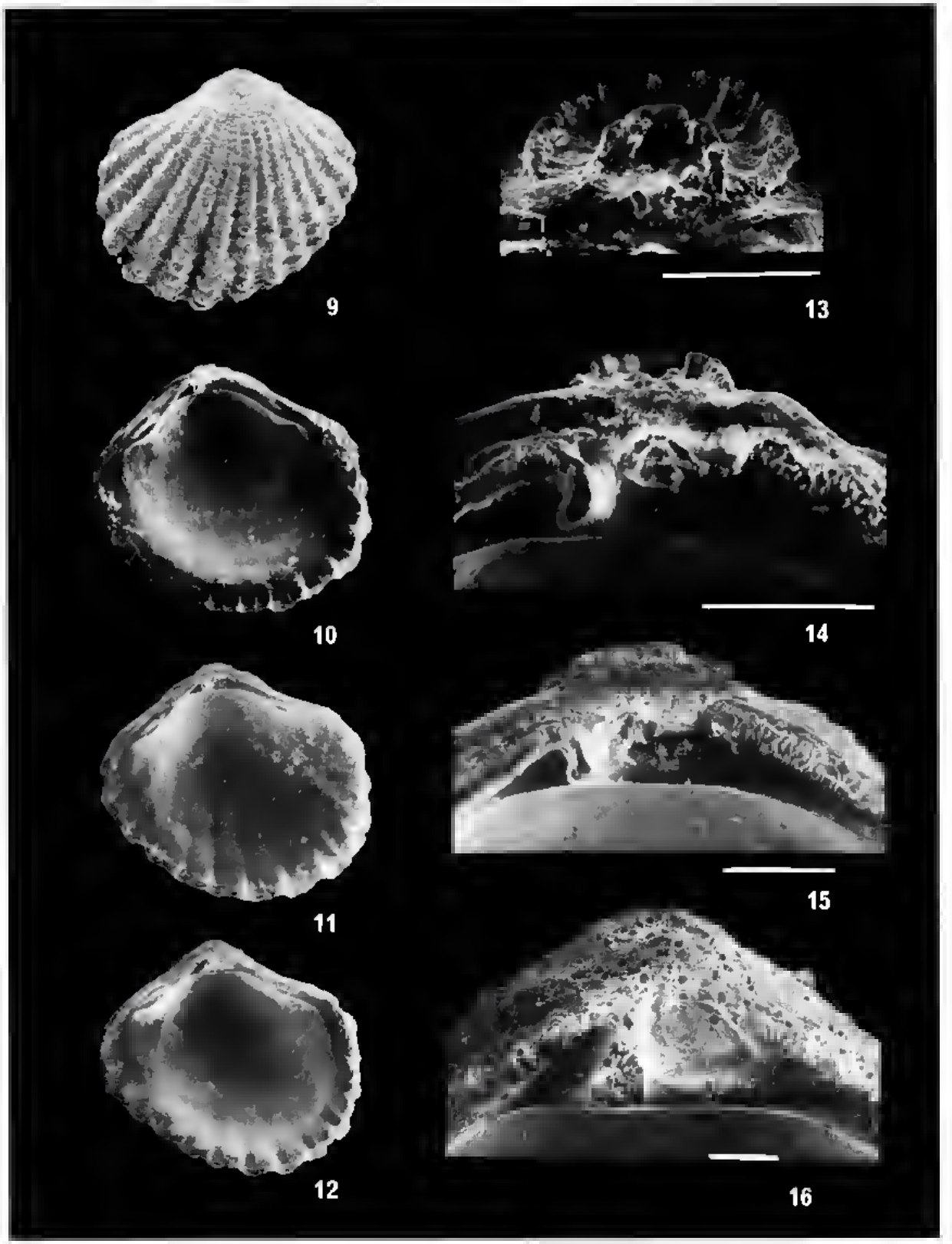


Source : MNHN, Paris

FIG. 9-16. — *Condylocardia angolensis* n. sp. (right valves). Scales bars are 100 μm.

9. Exterior. Lucira (Sta. Marta). Actual length 1.5 mm. MNCN
10. Interior. Lucira (Sta. Marta). Actual length 1.1 mm. MNHN.
11. Interior of another valve. Lucira (Sta. Marta). Actual length 1.2 mm. IICT.
12. Interior. Lucira (Bissonga). Actual length 2.1 mm. MNHN.
13. Protoconch. Lucira (Sta. Marta).
14 Cardinal area (fig. 10).
15. Cardinal area (fig, 11).
16. Cardinal area (fig. 12).

Source : MNHN, Paris

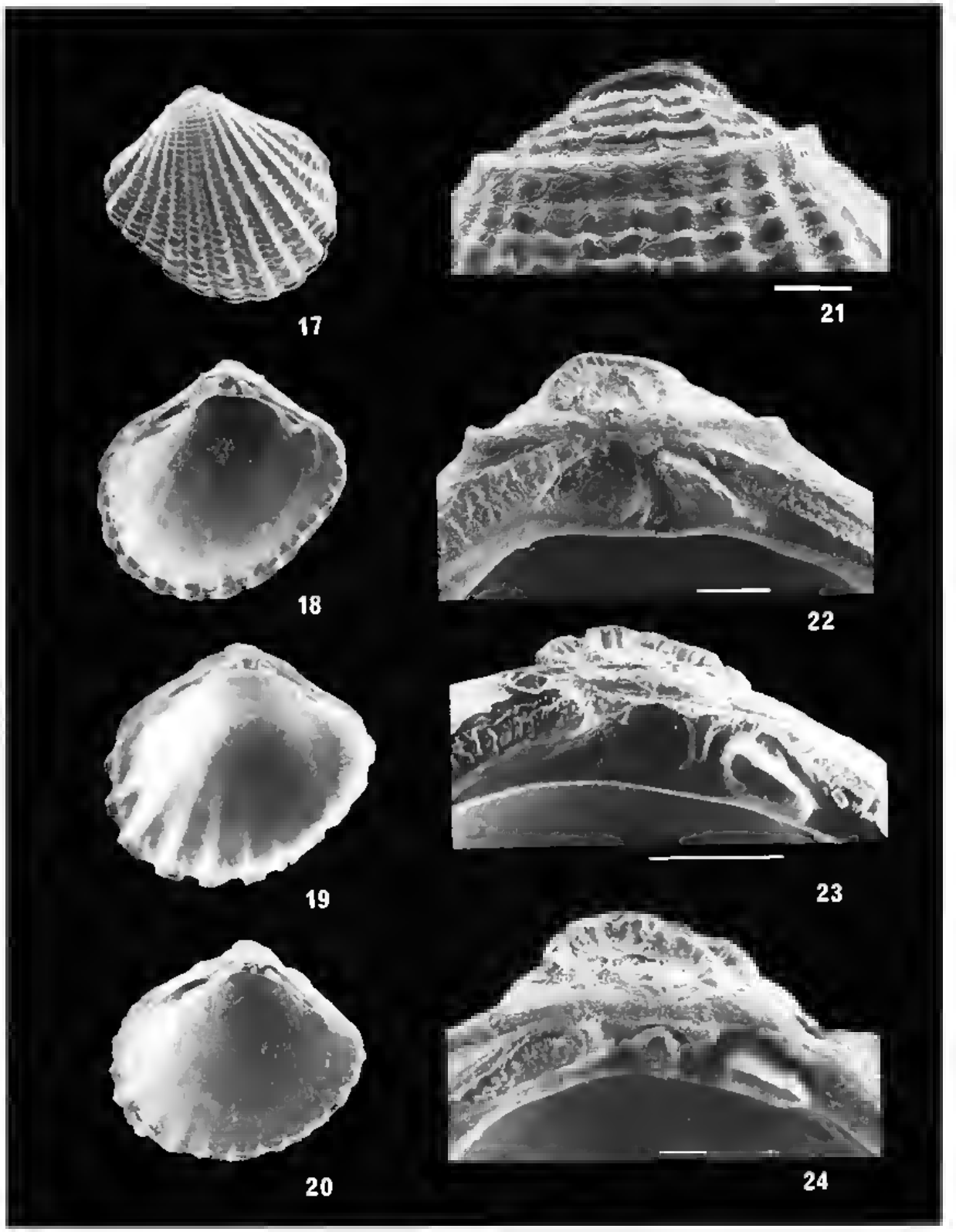


Source : MNHN, Paris

FIG. 17-24. — *Condylocardia angolensis* n. sp. (left valves). Scale bars are 100 µm.

17. Exterior of holotype. Lucira (Bissonga). Actual length 1.8 mm. MNHN.
18. Interior of holotype.
19. Interior of paratype. Lucira (Sta. Marta). Actual length 1.2 mm. MNCN.
20. Interior of paratype. Lucira (Sta Marta). Actual length 1.1 mm. IICT.
21 Protoconch of holotype.
22. Cardinal area (fig 18).
23. Cardinal area (fig. 19).
24. Cardinal area (fig. 20).

Source : MNHN, Paris

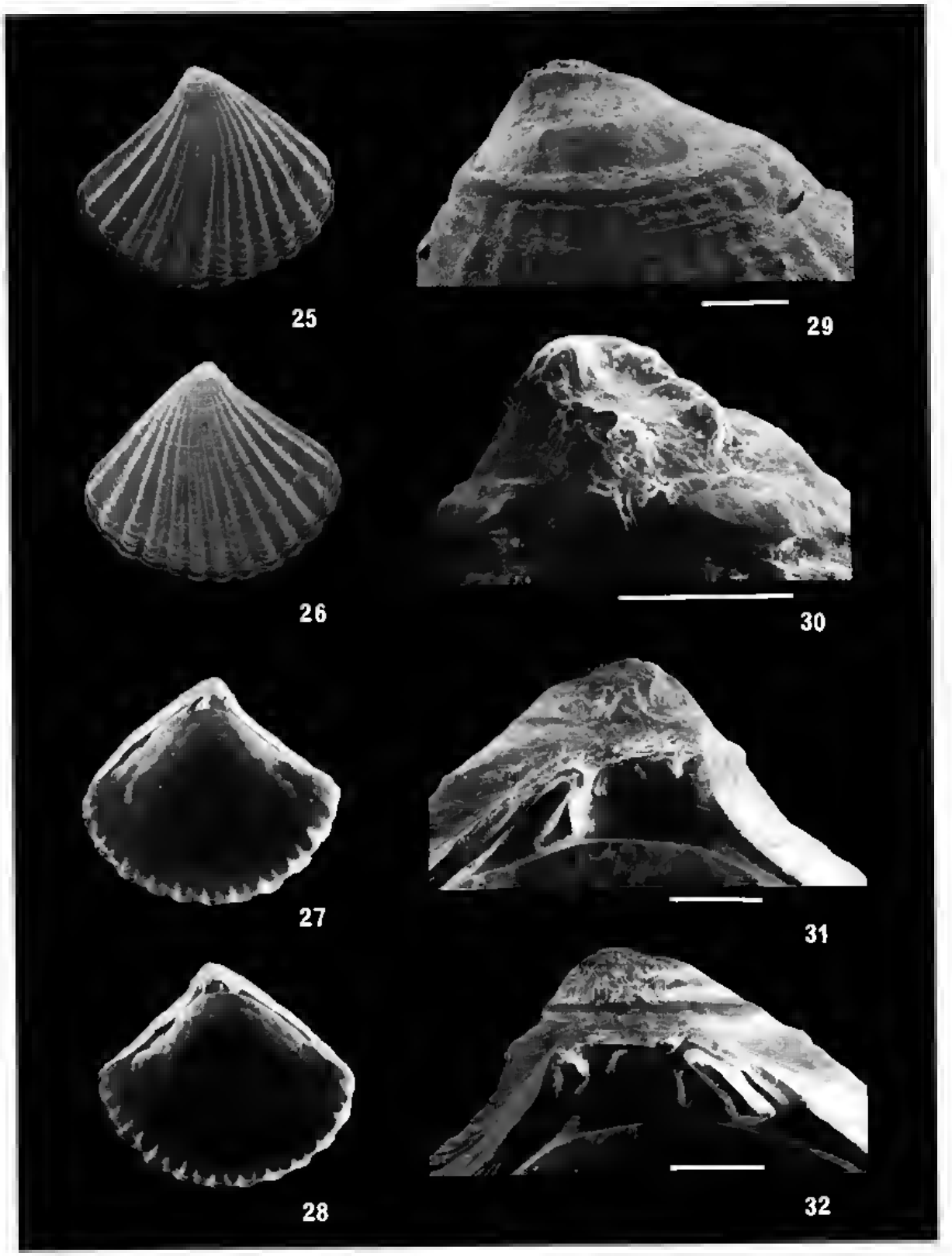


Source : MNHN, Paris

FIG. 25-32. — *Condylocardia ameliae* n. sp. Scale bars are 100 µm.

25. Exterior of right valve. Holotype. Praia Amelia, Namibe. Actual length 2.1 mm. MNHN.
26. Exterior of left valve. Holotype.
27. Interior of right valve. Paratype. Praia Amelia, Namibe. Actual length 1.6 mm MNHN.
28. Interior of left valve, same paratype.
29. Protoconch (fig. 25).
30. Protoconch of another left valve. Praia Amelia, Namibe.
31. Cardinal area of right valve (fig. 27).
32. Cardinal area of left valve (fig. 28).

Source : MNHN, Paris

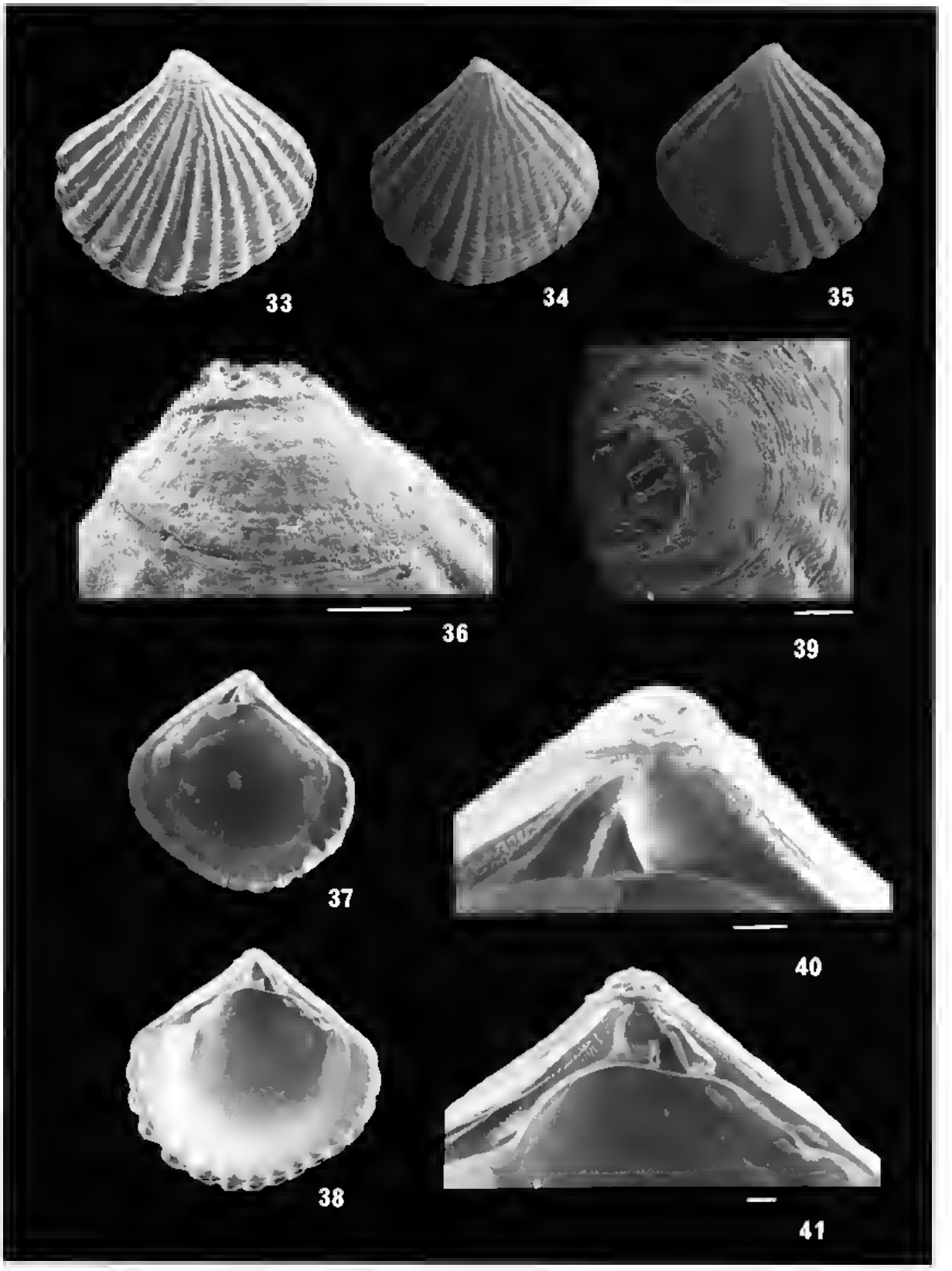


Source : MNHN, Paris

FIG. 33-41. — *Carditopsis gofasi* n. sp. Scale bars are 100 µm.

33. Exterior of right valve. Holotype. Ilha de Luanda. Actual length 2.1 mm. MNHN.
34. Exterior of right valve Paratype. Ilha de Luanda. Actual length 2.2 mm. MNHN.
35. Exterior of left valve, same paratype.
36. Protoconch.
37. Interior of right valve. Ambrizete. Actual length 2.5 mm. MNHN.
38. Interior of left valve. Ambrizete. Actual length 2.2 mm. MNHN.
39. Protoconch.
40. Cardinal area of right valve (fig. 37).
41. Cardinal area of left valve (fig 38)

Source : MNHN, Paris

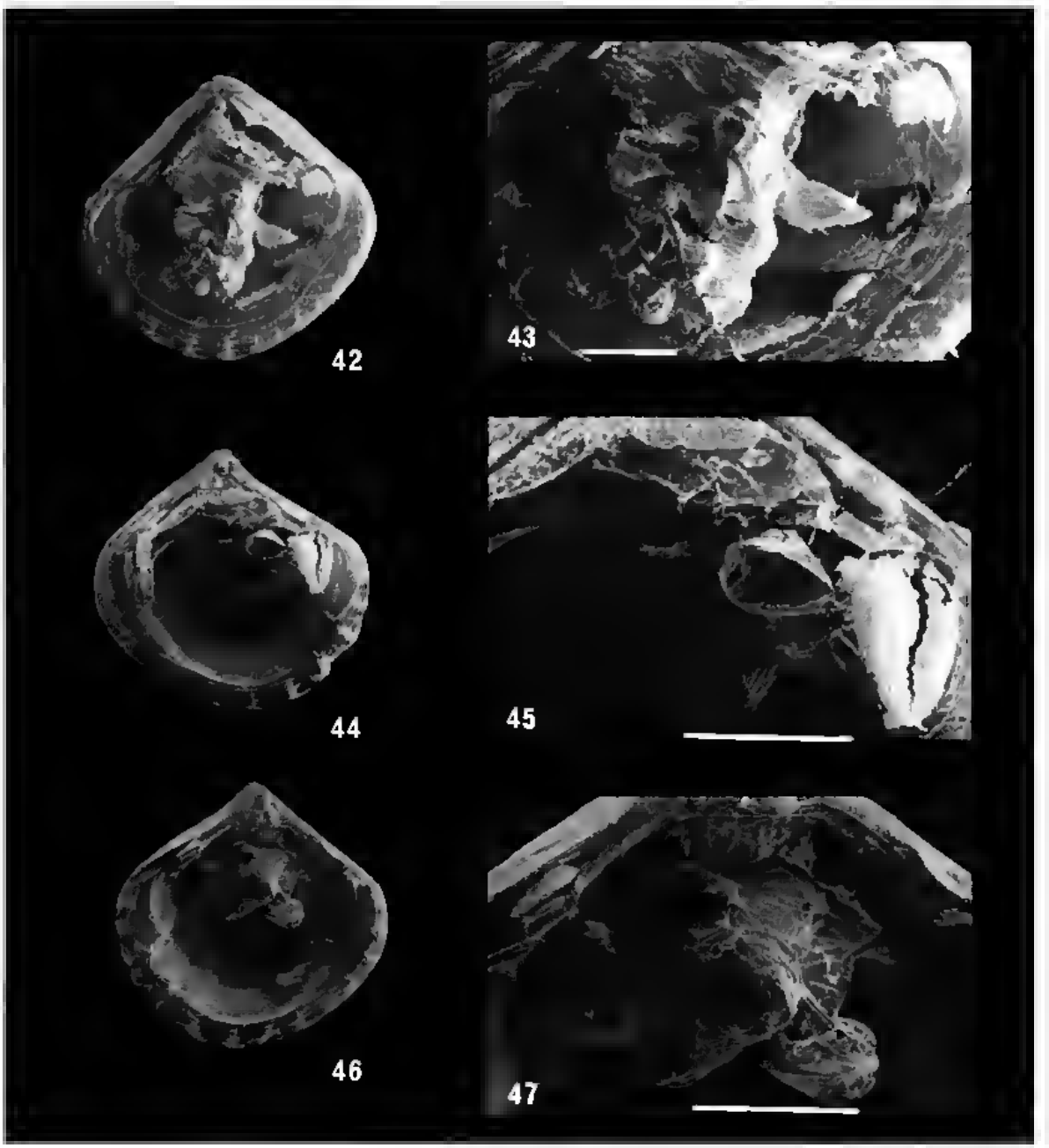


Source : MNHN, Paris

FIG. 42-47. — *Carditopsis gofasi* n. sp. Scale bars are 50 µm.

42. Interior of a left valve with incubating larval shells. Lucira (Praia Cesar). Actual length 3.3 mm.MNHN.
43. Detail of fig. 42, showing incubating larval shells, foot and gill filaments.
44. Interior of right valve with incubating larval shells. Ilha de Luanda. Actual length 2.3 mm. MNHN
45. Detail of fig. 44, showing incubating larval shells and remains of adductor muscles.
46. Interior of left valve of same specimen with incubating larval shells.
47. Detail of fig. 46, showing incubating larval shells and remains of gill filaments.

Source : MNHN, Paris



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Bull. Mus. natl. Hist. nat., Paris, 4e sér., 13, 1991,
section A, nos 3-4 : 283-288.

Approche architecturale des écomorphoses chez *Seriatopora hystrix* (Cnidaria : Scleractinia)

par Jean-Marc DAUGET

Résumé. — La comparaison entre des colonies de *Seriatopora hystrix* situées en milieux abrité et battu a permis de mettre en évidence des différences architecturales entre ces deux groupes. Celles-ci portent sur la densité plus ou moins forte de « complexes réitérés » dans la colonie. La réitération adaptative apparaît intervenir ainsi pour une large part dans les écomorphoses de cette espèce. L'approche architecturale apporte ici une nouvelle façon d'aborder les écomorphoses, fondée sur l'analyse structurale des systèmes d'axes élaborés par les colonies.

Abstract. — The comparison between colonies of *Seriatopora hystrix* located in wave-exposed and protected environments show here architectural differences between the two groups. These differences are based on the number of "reiterated complexes" within the colony. The adaptive reiteration seems to influence very largely the growth forms of this species. The architectural approach brings here a new vision of growth forms based on structural analysis of axes systems elaborated by colonies.

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INTRODUCTION

Les méthodes utilisées pour l'analyse architecturale des arbres tropicaux (HALLÉ et OLDEMAN 1970 ; HALLÉ *et al.*, 1978 ; OLDEMAN, 1974) ont été précédemment appliquées aux coraux (DAUGET, 1985, 1986 ; ROSEN et DAUGET, 1986 ; DAUGET, à paraître). Ce travail constitue un essai d'application de ces méthodes à l'étude des écomorphoses chez les coraux. L'étude des variations de la forme des colonies coralliennes liées au milieu, ou écomorphoses, a été abondamment abordée dans les vingt dernières années (notamment : LABOREL, 1969 ; GEISTER, 1972 ; JAUBERT, 1977 ; BOTTJER, 1980 ; GRAUSS et MACINTYRE, 1982 ; GATTUSO, 1987). Chez *Seriatopora hystrix* Dana, 1846, on connaît plusieurs écomorphoses, avec en milieu abrité des colonies ouvertes et en milieu agité des colonies d'aspect hérissé (VERON et PICHON, 1976). Cependant ces variations ont jusqu'à présent été analysées sur le plan physionomique, c'est-à-dire au niveau de l'aspect général de la colonie. Mon but est de franchir ici un pas supplémentaire en considérant l'axe et son mode de ramification.

Source : MNHN, Paris

Matériel et méthodes

Les observations ont été effectuées *in situ* sur la formation récifale corallienne de l'île Pari située à environ 60 km au nord de Jakarta (archipel des Seribu, mer de Java, Indonésie). Celle-ci est constituée d'un récif barrière d'environ 17 km de long entourant plusieurs lagons et cinq petites îles basses : Pari, Burung, Kongsi, Tengah et Tikus. L'étude a porté sur deux groupes de colonies situées les unes en milieu abrité, à faible profondeur, dans le lagon de l'île Tikus et les autres en milieu agité dans les dix premiers mètres de la pente externe du récif à proximité de la même île. La méthode d'étude est essentiellement graphique. La structure de chaque colonie est analysée en notant l'agencement tridimensionnel de ses axes et leur mode de ramification. Chaque observation est traduite par un schéma, et l'architecture de l'espèce est déduite de la comparaison des schémas entre eux. Par analogie avec les végétaux, j'utilise le terme « orthotrope » pour désigner les axes à potentialités de croissance verticale ou subverticale. J'applique également deux notions établies précédemment chez les arbres : le modèle architectural (Hallé et Oldeman, 1970) et la réitération du modèle (Oldeman, 1974). Chez les coraux, le modèle constitue l'architecture de base de la colonie (Dauget, 1986; Dauget, à paraître). La réitération consiste en l'apparition sur une colonie de structures répétant le modèle, ou « complexes réitérés ». La réitération survenant chez des colonies ayant subi un traumatisme, par exemple un changement d'orientation, ou « réitération traumatique », a été décrite précédemment (Dauget, 1985). Le processus réitératif peut également se manifester chez certaines espèces sans l'intervention d'un traumatisme extérieur, dans le cours normal du développement colonial; il est alors désigné par le terme de « réitération adaptative » (cf. Dauget, note à paraître).

Résultats

Les colonies de *Seriatopora hystrix* croissant en mode calme dans le lagon de l'île Tikus ont une physionomie très ouverte, avec des rameaux longs et grêles (fig. 1, a), tandis que celles de la pente externe ont un aspect densément ramifié (fig. 1, b). L'analyse architecturale des colonies du lagon montre qu'à partir de la phase encroûtante, cette espèce produit des axes dressés. Ceux-ci se ramifient par division de leur sommet en deux parties qui, en s'allongeant, produisent deux nouveaux axes. Ces derniers se ramifient à leur tour apicalement suivant le même processus. Ce mode de croissance très simple constitue le modèle architectural de cette espèce au sens de Hallé et Oldeman (1970) (fig. 2, a). La connaissance du modèle ne suffit cependant pas ici à expliquer en totalité les structures observées. En effet, sur certaines colonies apparaissent de nouveaux axes issus d'une ramification latérale. Ces derniers poursuivent leur croissance en se ramifiant apicalement et répètent ainsi le modèle, il s'agit donc de complexes réitérés au sens d'Oldeman (1974) (fig. 2, b, c; fig. 3).

En revanche, les colonies de mode battu sur la pente externe présentent une architecture plus complexe. Le nombre des ramifications apicales est réduit et celui des complexes réitérés est plus important. La densité de réitération est parfois telle que de jeunes complexes réitérés

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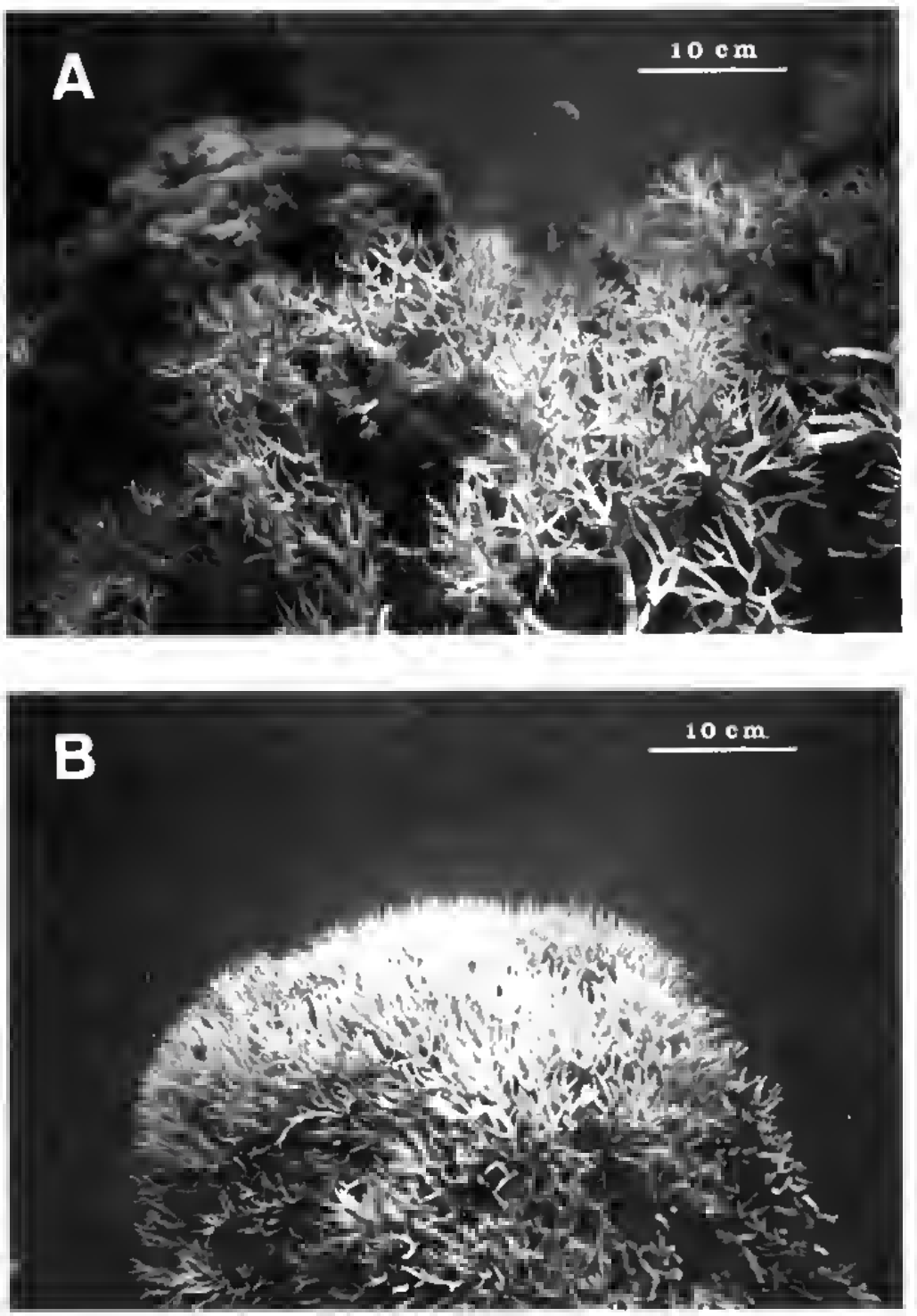

FIG. 1. — Deux formes de croissance chez *Seriatopora hystrix* : A, dans le lagon ; B, sur la pente externe.
Two growth forms in Seriatopora hystrix : A, *in the lagoon* ; B, *on the reef-slope.*

Source : MNHN, Paris

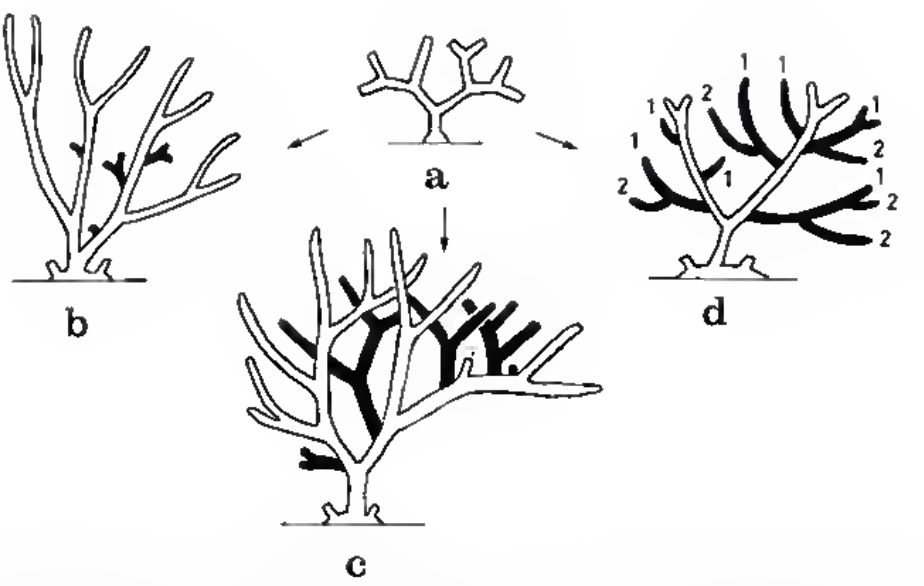

FIG. 2. — *Seriatopora hystrix* : a, modèle de base ; b, c, schéma architectural des colonies du lagon ; d, schéma des colonies de la pente externe : 1, complexes réitérés d'ordre 1 ; 2, complexes réitérés d'ordre 2.

Seriatopora hystrix : a, *basic growth model* ; b, c, *architectural scheme of the colonies growing in the lagoon* ; d, *scheme of the colonies growing on the reef slope* : 1, *reiterated complexes of first order* ; 2, *reiterated complexes of second order*.

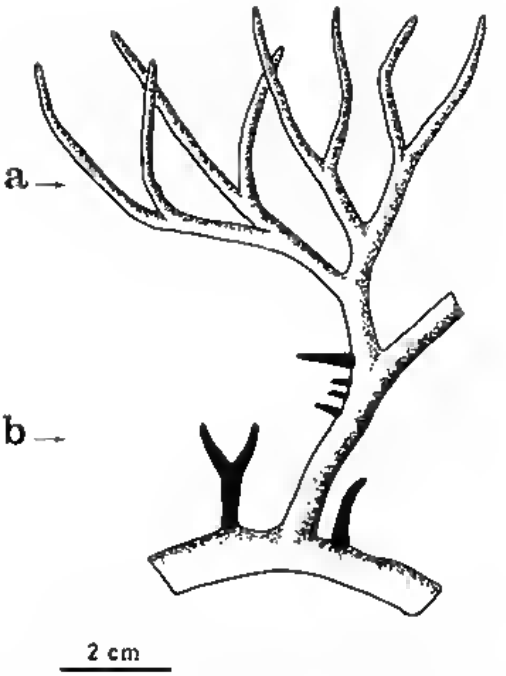

FIG. 3. — Complexes réitérés dans un fragment de colonie de *Seriatopora hystrix* : a, parties ramifiées apicalement ; b, parties sur lesquelles se sont développés latéralement des complexes réitérés (figurés en noir).

Reiterated complexes in a Seriatopora hystrix *colony fragment* : a, *parts showing apical branching* ; b, *parts on which developed laterally reiterated complexes (black coloured)*.

Source : MNHN, Paris

d'ordre 1 donnent naissance á des complexes réitérés d'ordre 2 avant d'avoir produit une ramification apicale. Ainsi certaines parties des colonies apparaissent ramifiées presque entiérement latéralement (fig. 2, d).

Conclusion

L'analyse architecturale de *Seriatopora hystrix* permet de montrer que sa structure est constituée d'axes orthotropes á ramification apicale, et de complexes réitérés latéraux qui répétent cette architecture à partir d'une ramification latérale. Les colonies en mode calme sont peu ou moyennement réitérées tandis que celles en mode plus exposé sont abondamment réitérées, ce qui complique leur architecture. Dans certains cas, la densité de réitération est telle que c'est la ramification latérale qui domine au sein des colonies. On voit donc que les différences observées entre les deux groupes de colonies étudiés ne se situent pas seulement sur le plan physionomique mais également au niveau architectural. Les modalités d'expression du processus réitératif apparaissent intervenir ici pour une part importante dans les écomorphoses chez cette espéce. L'étude de la réitération adaptative apporte un nouvel élément pour l'analyse structurale des colonies et pourrait trouver une plus large application dans l'étude des écomorphoses chez les coraux récifaux.

Remerciements

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Bull. Mus. natl. Hist. nat., Paris, 4e sér., **13**, 1991,
section A, nos 3-4 : 289-307.

Caractéristiques des spicules et du squelette carbonaté des espèces actuelles du genre *Merlia* (Démosponges, Merliida), et comparaison avec des Chaetétides fossiles

par Pascale GAUTRET, Jean VACELET et Jean-Pierre CUIF

Résumé. — L'étude de spécimens d'origines géographiques diverses des deux espèces calcifiantes du genre actuel *Merlia* (Démosponge, Tétractinomorphe, Merliidae) fait apparaître que malgré les différences spiculaires qui séparent les deux espèces, les caractéristiques minéralogiques et microstructurales de leurs squelettes carbonatés sont très stables dans le genre. Ce squelette est uniformément calcitique, avec des teneurs élevées en magnésium, et les modalités de sa formation, révélées par l'analyse de sa microstructure, permettent de distinguer très nettement les structures carbonatées élaborées par les *Merlia* de celles que produisent d'autres Démosponges actuelles. Cette microstructure caractéristique se retrouve, avec une grande précision, chez des formes chaetétoïdes du Paléozoïque (*Chaetetes cylindraceus*, Carbonifère) et du Jurassique (*Blastochaetetes bathonicus*), suggérant des affinités poussées entre ces fossiles et le genre actuel. Leur absence dans les formations du Permien et du Trias, périodes réputées favorables au développement de l'aragonite dans les milieux sédimentaires, est mise en parallèle avec l'impossibilité, chez certaines *Merlia* actuelles, de produire un squelette carbonaté.

Abstract. — A study of specimens of two Recent calcified species from the genus *Merlia* sampled at diverse localities shows that although spicular differences separate the two species, mineralogical and microstructural characteristics of their calcareous skeleton remain highly constant. This skeleton is uniformly made up of high magnesium calcite. Microstructural analysis and growth mode made it possible to distinguish the calcium carbonate structures of *Merlia* from those produced by other Recent demosponges. These characteristic microstructural features can also be found in both Paleozoic and Jurassic chaetetids, respectively *Chaetetes cylindraceus* and *Blastochaetetes bathonicus*, which suggests phylogenetical affinities between these fossils and Recent *Merlia*. Their absence during the Permo-Trias period, which is known to have encouraged aragonite development, is related to the fact that some Recent species of *Merlia* are presently unable to produce a carbonate skeleton.

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INTRODUCTION

L'interprétation des Chaetétides fossiles a été bouleversée par la découverte d'un survivant des Acanthochaetétidés, *Acanthochaetetes wellsi* Hartman & Goreau, 1975, qui a montré de façon irréfutable qu'il ne s'agissait pas de Cnidaires, mais de Spongiaires calcifiés. Par sa spiculation et les caractères de ses tissus vivants, la forme actuelle peut être classée très précisément dans les Démosponges Hadromérides, au voisinage de la famille non calcifiée des

Source : MNHN, Paris

Spirastrellidae (VACELET, 1985) ; on a même proposé son intégration dans le genre *Spirastrella* (REITNER & ENGESER, 1987), pourtant dépourvu du squelette calcaire. La correspondance très exacte entre les microstructures du squelette carbonaté de la forme actuelle (calcite microlamellaire) et celles de certaines formes fossiles suggère que ces dernières avaient les mêmes affinités et, bien qu'exceptionnelle, la présence chez les fossiles de spicules du même type confirme cette parenté.

Ces affinités ne concernent cependant qu'une partie de ce vaste ensemble fossile des Chaetétides, dont il est maintenant clair qu'il constitue un groupe très hétérogène. A côté des Acanthochaetétides, de nombreuses formes chaetétoïdes, du Trias notamment, ont des affinités nettes avec une autre Démosponge calcifiée actuelle, *Ceratoporella nicholsoni* Hickson (DIECI *et al.*, 1977), tandis que *Antalyopsis spherolitica* Cuif a une microstructure sphérolitique identique à celle de l'actuelle *Astrosclera willeyana* Lister (CUIF, 1983). Cependant, d'autres Chaetétides fossiles n'ont aucun représentant actuel connu. Ce sont par exemple les Varioparietidae, tels qu'ils ont été définis par FISCHER (1970), caractérisés par une microstructure granulaire, ou des espèces chaetétoïdes du Crétacé, pourvues d'une spiculation inconnue chez les Démosponges calcifiées actuelles (CHERCHI & SCHRÖDER, 1987 ; WOOD & REITNER, 1988). La position du genre *Chaetetes* lui-même, et ses relations avec des formes actuelles, étaient jusqu'à présent complètement indéterminées.

Parallèlement, les éponges calcifiées actuelles du genre *Merlia*, encore imparfaitement analysées, étaient considérées comme dépourvues de correspondants fossiles précis. Elles ont été rapprochées des Chaetétides (VACELET, 1980*a* ; TERMIER & TERMIER, 1980), mais ce rapprochement était fondé sur la seule architecture générale du squelette calcifié (KIRKPATRICK, 1911), et un des buts de ce travail est l'établissement d'une comparaison plus précise. La vérification de ces similitudes aux niveaux d'observation maintenant accessibles et l'appréciation de la valeur phylogénétique des caractéristiques communes à ces divers squelettes sont évidemment nécessaires à l'élaboration d'un cadre taxonomique incluant les formes actuelles et les formes fossiles.

Cette recherche des correspondances entre le genre *Merlia* et des formes fossiles nécessitait par ailleurs un réexamen des données fournies par les *Merlia* actuelles, qui apparaissent assez incohérentes.

Le genre *Merlia* a longtemps été considéré comme une chimère, correspondant au squelette d'un organisme calcifié, perforé par une éponge siliceuse (WELTNER, 1909). Les observations récentes ont donné raison à KIRKPATRICK (1911) qui soutenait qu'il s'agissait d'un organisme unique, capable de sécréter simultanément un squelette calcaire et un squelette siliceux.

Toutefois, la définition du genre est maintenant rendue très difficile par l'inconstance des principaux caractères squelettiques. En effet, parmi les quatre espèces actuelles, deux (*Merlia normani* Kirkpatrick, 1908 et *M. lipoclavidisca* Vacelet & Uriz, 1991) produisent des spicules siliceux et un squelette supplémentaire calcifié, tandis que deux autres (*M. deficiens* Vacelet, 1980*a* et *Merlia tenuis* Hoshino, 1990) sont dépourvues du squelette carbonaté et, comme la majorité des Démosponges actuelles, ont un squelette uniquement spiculaire. Les deux espèces dépourvues de squelette calcaire sont placées dans ce genre en raison de leur spiculation, identique à quelques détails près à celle de l'espèce-type, *M. normani*, et caractérisée par un microsclère très original, le clavidisque. Or, ce microsclère est absent chez *M. lipoclavidisca*, dont le squelette calcifié et les tissus vivants sont pourtant identiques à ceux de *M. normani*.

Source : MNHN, Paris

De plus, une incertitude subsiste sur la nature minéralogique du squelette calcaire, les diverses analyses publiées faisant état de prédominance tantôt calcitique, tantôt aragonitique. Ce dernier point méritait d'être éclairci, car cette minéralisation variable constituerait, sur le plan biologique, un phénomène intéressant dans le problème des modalités de la biominéralisation (LOWENSTAM, 1964). Elle pourrait aussi obérer les possibilités d'utilisation des critères squelettiques microstructuraux, qui sont en train de révolutionner la taxonomie des formes fossiles.

Ce travail a pour but de préciser la nature et la microstructure du squelette des *Merlia* actuelles pour clarifier ces incohérences et de rechercher, aux niveaux d'observation maintenant accessibles, quels pourraient être leurs équivalents fossiles.

I. — MATÉRIEL ET MÉTHODES D'ÉTUDE

Les squelettes des spécimens analysés proviennent de :

— *Merlia normani* : Porto Santo (archipel de Madère), spécimen de KIRKPATRICK conservé au British Museum, 4.6.1910; cap Matapan (Grèce), station 1516 du N.O. « Calypso », entrée de grotte, 15 m, 9.1955; Sorrente (Italie), grotte « Zaffiro », 5 m, 29.5.1974; grotte Santa Catarina (sud de l'Italie), grotte, 8 m, 1.6.1980.

— *Merlia lipoclavidisca* : Majorque (Baléares), grotte « La Catedral », 12 m, 16.1.1986.

L'étude des spécimens fossiles a été conduite sur *Chaetetes cylindraceus* F. de Waldheim (Carbonifère de Moscou) et sur *Blastochaetetes bathonicus* Fischer (Bathonien d'Hocqmont) grâce à des fragments des holotypes et de spécimens communiqués par J.-C. FISCHER, matériel qui a servi de base à une révision taxonomique des Chaetétides (FISCHER, 1970).

Les observations morphologiques et microstructurales en microscopie électronique à balayage ont été réalisées sur des surfaces polies orientées selon la direction de croissance, après une attaque ménagée par l'acide formique dilué (5 %, pendant 10 secondes), qui met clairement en évidence les directions de croissance des fibres.

Les caractéristiques minéralogiques ont été établies en utilisant un détecteur EDS (Link AN 10000), associé au microscope Philips 505. Contrairement aux déterminations cristallographiques nécessitant un prélèvement de matériel, cette méthode permet une localisation des analyses avec une résolution qui exclut tout risque d'interférence avec des matériaux allochtones. Des structures aussi fines et poreuses que les squelettes des *Merlia* sont toujours susceptibles de comporter une phase minérale étrangère au squelette lui-même (autre organisme ou précipitation sédimentaire).

II. — CARACTÉRISTIQUES SPICULAIRES DU GENRE *Merlia*

Les spicules siliceux de *Merlia normani* ont été décrits par KIRKPATRICK (1911). Ce sont des mégasclères tylostyles groupés en faisceaux isolés dans les tissus superficiels, et des microsclères divers (pl. 1, 1 et 2) : commates, raphides et clavidisques. Les variations spiculaires, chez les diverses espèces du genre, sont faibles et portent surtout sur de minimes

Source : MNHN, Paris

différences dans les dimensions (VACELET & URIZ, 1991), sauf chez *M. lipoclavidisca* où les microsclères, y compris les clavidisques, sont absents.

Malgré cette exception, ce spicule très particulier, qui n'a jusqu'à présent pas été observé chez d'autres spongiaires, est suffisamment caractéristique pour que l'on puisse penser que le genre existait dès l'Oligocène. En effet, HINDE et HOLMES (1892) ont décrit des clavidisques typiques, bien que nettement plus grands que ceux des espèces actuelles (130 µm de long au lieu de 37 à 90 µm selon les espèces), dans des sédiments contenant des spicules exceptionnellement préservés de l'Oligocène de Oamaru (Nouvelle-Zélande). Ces spicules ont été attribués à une espèce disparue, décrite sous le nom de *Melonanchora morlandi*. Dans la mesure où ce type de spicule apparaît très caractéristique du genre dans l'actuel, on doit classer cette espèce dans le genre *Merlia*. On ignore si *Merlia morlandi* possédait un squelette calcifié.

Les spicules ne sont pas inclus dans le squelette calcaire chez les espèces de *Merlia* où il est présent. Ils sont donc tous dispersés lors de la décomposition des tissus, et les chances de fossilisation simultanée des spicules et du squelette carbonaté sont très faibles. On remarque d'ailleurs que les squelettes subfossiles observés dans une grotte émergée à la faveur d'un soulèvement tectonique datant de 1 500 ans (VACELET, 1980*b*) ont perdu tous leurs spicules. Ceci est différent de la situation rencontrée chez la plupart des autres éponges calcifiées actuelles, où les spicules, siliceux ou calcaires, sont en partie inclus dans le squelette et, malgré de nombreux phénomènes de dissolution, ont quelques possibilités de fossilisation en place. Le seul autre cas où les spicules sont entièrement libres est celui de *Murrayona phanolepis*, à spicules calcaires. Chez *Acanthochaetetes wellsi*, la majorité des spicules sont libres, mais quelques microsclères sont attachés au squelette et peuvent se fossiliser (REITNER & ENGESER, 1987). Dans le cas des *Merlia*, il est donc normal que les fossiles qui lui sont apparentés soient dépourvus de spicules.

Ces spicules et leur arrangement (en faisceaux isolés), ainsi que les caractères des tissus vivants, n'indiquent pas clairement la position taxonomique du genre. La plupart des auteurs (KIRKPATRICK, 1911 ; HARTMAN & GOREAU, 1970 ; SOEST, 1984) ont rapproché le clavidisque du diancistre des *Hamacantha*, qui sont des Démosponges Céractinomorphes de l'ordre des Poecilosclerida, et ces affinités seraient encore renforcées par la présence de sigmates.

Toutefois, VACELET (1979; 1981) et VACELET & URIZ (1991) soutiennent plutôt des affinités avec les Démosponges Tétractinomorphes. En effet, les clavidisques apparaissent comme des cercles à l'état jeune et n'ont, avec les diancistres, qu'une ressemblance superficielle due à l'épaississement de leur partie latérale qui donne naissance à un « key-hole shaped notch ». De même, les sigmates, qui sont plutôt des commas, ne sont pas sûrement des microsclères chéloïdes. En revanche, certains caractères des tissus vivants (collagène de type lisse, possibilité d'accumulations d'archéocytes gemmulaires) sont en faveur d'affinités avec les Tétractinomorphes. Aussi, contrairement à SOEST (1984) qui inclut les *Merlia* dans la famille des Biemnidae des Poecilosclérides, nous préférons isoler ces éponges dans un ordre *incertae sedis* Merliida Vacelet, 1979, en attendant des données plus précises sur la reproduction et les caractères des tissus vivants.

Source : MNHN, Paris

III. — Caractéristiques minéralogiques et microstructurales du squelette calcaire chez *Merlia normani* et *M. lipoclavidisca*

1. Minéralogie

Les résultats obtenus par différents auteurs sur la nature minéralogique des squelettes de *Merlia* sont contradictoires, ainsi que le montre le tableau 1.

Tableau 1. — Composition minéralogique du squelette carbonaté de *Merlia normani*, d'après les diverses analyses publiées. (1) : Analyse par densité et test de Meigen. (2) : Sans précisions sur les échantillons et sur les analyses. (3) : Diffraction aux rayons X. (4) : Microsonde.

	Provenance	Squelette
Kirkpatrick, 1911 (1)	Madère	Calcite
Hartman & Goreau, 1970 (2)	?	Aragonite
Stearn, 1975 (3)	Madère	Calcite 80-90 % Aragonite 10-20 %
Stearn, 1977 (4)	Madère	Calcite
Vacelet, 1980*a* (3)	Madère (JC 24)	Calcite
Vacelet, 1980*a* (3)	Cap Matapan	Aragonite 90 % Calcite 10 %
Vacelet, 1980*a* (3)	Sorrente	Calcite
Vacelet, 1980*a* (3)	Naples	Calcite

Nos résultats, fondés sur des mesures effectuées ponctuellement, ne confirment pas cette variabilité (tableau 2).

Tableau 2. — Teneurs pondérales en éléments mineurs (en %) associés au squelette carbonaté de *M. normani* et de *M. lipoclavidisca*.

	Teneurs (en %)				
Origine des spécimens	Mg	Al	S	Fe	Sr
Sorrente (*M. normani*)	3,0	0,1	0,4	0	0,3
Matapan (*M. normani*)	3,3	0,1	0,5	0	0,2
Porto-Santo (*M. normani*)	3,1	0,3	0,4	0	0,2
Baléares (*M. lipoclavidisca*)	3,0	0,1	0,3	0	0,2

Sur le plan minéralogique, ces résultats témoignent d'une grande homogénéité. Quelle que soit l'origine des matériels étudiés, leur composition élémentaire est identique. Une teneur en magnésium élevée et une teneur en soufre également forte sont inconnues dans des matériaux squelettiques aragonitiques. La corrélation de ces deux indices est très nettement en faveur d'une minéralogie uniformément calcitique du squelette des *Merlia*. Les mélanges observés dans les diagrammes de rayons X antérieurement établis tiennent probablement à ce qu'il est

Source : MNHN, Paris

tout à fait impossible de se débarrasser des cristaux d'origine non biologique, formés dans les cellules fermées résultant du cloisonnement des tubes squelettiques.

2. Caractéristiques microstructurales

Modalités de formation des parois squelettiques

Les figurations initiales (KIRKPATRICK, 1908, 1911) ont bien mis en évidence les particularités morphologiques de la surface de croissance des édifices calcaires produits par *Merlia normani*. A chaque point de jonction des parois édifiant les cavités fonctionnelles cylindriques s'élève une tigelle squelettique dont le microscope électronique permet d'observer en détail l'organisation (pl. I, 3). La région distale de ces éléments verticaux présente un aspect noduleux dû à l'individualisation des faisceaux fibreux centrés dans l'axe et à direction de croissance radiaire. La permanence de cette morphologie particulière de la surface tout au long de la croissance peut être aisément mise en évidence par une légère attaque de la structure dans les régions plus profondes du squelette. Le tracé des stries d'accroissement révèle continuellement la présence de ces expansions fibreuses autour d'une partie proéminente au sommet de la tigelle axiale (pl. I, 4 à 6).

Ces axes constituent les éléments fondamentaux de tout l'édifice calcaire, puisque le développement des faisceaux qui les constituent se poursuit jusqu'à ce qu'ils entrent en contact avec ceux qui sont issus des axes voisins (pl. II, 2 à 4). Il n'y a donc pas production de centres de calcification intermédiaires, situés entre ceux qui sont définis lors de la formation des tigelles verticales. Chaque cavité fonctionnelle se trouve ainsi délimitée par la rencontre des faisceaux issus de trois ou quatre tigelles axiales uniquement. Ce point paraît être d'une particulière importance pour la comparaison avec les dispositions microstructurales de formes fossiles.

Orientation des fibres dans les axes squelettiques

Les fibres sont sensiblement verticales dans la partie axiale des unités microstructurales et s'infléchissent régulièrement en progressant vers leur périphérie. Cette disposition se distingue donc très nettement des types trabéculaires, dans lesquels les fibres font un angle bien défini et constant avec l'axe de l'unité microstructurale. Elle diffère également du type pénicillé tel qu'il a été défini par DIECI *et al.* (1974) chez *Eudea* et les Cératoporellides triasiques, dans lequel les fibres sont groupées en cônes aigus, à disposition sensiblement verticale.

Modalités de formation des planchers

Les planchers, ou « tabulae », sont édifiés en continuité microstructurale avec les éléments verticaux. Les faisceaux de fibres impliqués dans la formation de ces structures s'infléchissent progressivement jusqu'à prendre une direction de croissance presque horizontale (pl. I, 7 et 8). Ils convergent alors vers le centre de la cavité fonctionnelle. L'observation morphologique des faces supérieures et inférieures des planchers permet d'observer les faisceaux accolés, mais assez nettement distincts, qui les constituent (pl. II, 1). Ces faisceaux de fibres n'atteignent cependant pas l'axe des tubes, déterminant ainsi la formation d'un orifice central permettant la communication entre les loges. Le caractère fonctionnel de cette disposition est lié à la

Source : MNHN, Paris

présence de tissus de résistance, constituant les « pseudogemmules », dans les loges du squelettes (VACELET, 1990).

La continuité microstructurale existant entre les éléments constitutifs des parois et les planchers implique que ces derniers soient formés par un repli de l'épithélium sécréteur, dont le fonctionnement ne subit aucune interruption. La continuité des stries de croissance, passant des axes aux planchers, constitue le témoin de la formation de ce repli. En cela, ce type de plancher se distingue fondamentalement des dispositions observables chez les Cératoporellides actuelles (ou les *Atrochaetetes* triasiques, qui sont leurs équivalents fossiles), chez lesquelles les obturations plus ou moins complètes des tubes se réalisent par une reprise de la sécrétion, postérieurement à la mise en place des parois.

Évolution de la morphologie des constituants fibreux du squelette au cours de la croissance

La morphologie des fibres calcitiques qui constituent l'ensemble de l'édifice squelettique (parois et planchers, résultant d'un processus de sécrétion continu, ne pouvant être dissociés) se modifie de manière très sensible au cours de la croissance (pl. II, 5).

Dans la partie superficielle du squelette, des structures finement fibreuses, recoupées par des stries d'accroissement espacées d'une dizaine de micromètres seulement, sont clairement visibles (pl. I, 5; pl. II, 6).

Dans la région basale, une altération se produit, du vivant même de l'animal, rendant presque méconnaissables les dispositions caractéristiques de ce type de biominéralisation. Cette altération se manifeste déjà dans les parties moyennes du squelette, par une irrégularité de la dimension des fibres, dans une structure où les stades de croissance successifs sont encore bien apparents. Dans les parties les plus profondes, cette évolution aboutit à la fusion des fibres en larges cristaux presque compacts (pl. II, 5 et 7).

IV. — RAPPORTS AVEC LES FOSSILES

Bien que le squelette calcaire des *Merlia* soit de faible épaisseur, son architecture tabulaire autorise une comparaison avec des types qui, dans les formations construites anciennes, édifiaient sur le même plan des constructions d'un volume incomparablement plus important.

C'est dans le groupe des Chaetétides que l'on peut trouver des formes présentant des similitudes poussées avec la construction calcaire des *Merlia*, ressemblances portant à la fois sur l'architecture de l'édifice et la microstructure des constituants. Ainsi, le genre *Chaetetes* lui-même, par les caractéristiques de son espèce-type (*C. cylindraceus* F. de Waldheim), permet de conduire cette comparaison jusqu'à un niveau très avancé.

1. Microstructure de *Chaetetes cylindraceus*

Cette espèce a été revue par LAFUSTE & FISCHER (1971), qui ont mis en évidence les traits généraux de sa structure squelettique. C'est à partir de fragments de l'holotype de l'espèce (communiqués par J. C. FISCHER) qu'ont été acquis les renseignements complémentaires, permettant la comparaison avec le squelette des *Merlia*.

Source : MNHN, Paris

Microstructure des parois

Le spécimen est formé de tubes jointifs à parois compactes, de 200 à 300 µm de diamètre, pourvus de planchers régulièrement espacés.

Les figures 1 et 2 de la planche III fournissent, pour la constitution des parois, des indications microstructurales très claires.

Au point de jonction des parois des tubes, sur les sections perpendiculaires à la direction de croissance, les fibres sont coupées transversalement. Elles présentaient donc une direction verticale, indiquant que devait se trouver à chaque point de jonction une zone très proéminente. Latéralement, les fibres s'infléchissent vers chacune des parois issues de cet axe et apparaissent coupées de plus en plus longitudinalement. Elles s'affrontent, au milieu de chaque paroi, aux faisceaux de fibres issus d'un axe situé au point de jonction voisin (pl. III, 2; fig. 1).

Cet affrontement selon une ligne verticale continue est également très nettement visible dans les sections longitudinales qui sont effectuées dans une paroi, entre deux axes voisins (pl. III, 1). Il est donc clair qu'il n'existait pas de centre de minéralisation intermédiaire entre ceux qui déterminent la formation de ces axes.

C'est une architecture exactement identique à celle des *Merlia*.

Modalités de formation des planchers

La figure 4 de la planche III indique nettement la constitution de ces éléments tabulaires par la convergence de faisceaux de fibres dans la lumière des tubes. Malgré les modifications entraînées par la diagenèse (accroissement syntaxique des fibres), les directions d'orientation générale des faisceaux sont encore visibles.

Les coupes longitudinales (pl. III, 3) permettent d'établir que, comme chez les *Merlia*, ces faisceaux de fibres ne sont pas des composants autonomes, ajoutés après la mise en place des parois tubulaires (comme c'est le cas chez les Cératoporellides par exemple : cf. *Atrochaetetes*). Chez *Chaetetes cylindraceus*, les faisceaux constituant les planchers se forment par inflexion progressive des fibres, à partir des axes verticaux.

Sous cet angle également, la similitude avec les *Merlia* est très prononcée.

Minéralogie

Bien que les fibres aient subi d'évidentes modifications diagénétiques (cimentation syntaxique, développement de rhomboèdres de néogenèse, probablement dolomitiques), le squelette de cette espèce carbonifère est encore remarquablement conservé. Du point de vue de sa minéralogie, il est calcitique, et rien dans sa disposition actuelle ne permet de suggérer un processus de recristallisation généralisée qui l'aurait amené à cet état minéralogique à partir d'une sécrétion initialement aragonitique. Il est donc très vraisemblable que ce squelette a été produit directement en calcite, comme chez les *Merlia* actuelles.

2. **Microstructure des *Blastochaetetes* du Jurassique**

Au Mésozoïque, le genre *Blastochaetetes* constitue le taxon principal de la famille des Chaetétides proprement dits (Fischer, 1970). Il se distingue aisément du genre type de la

Source : MNHN, Paris

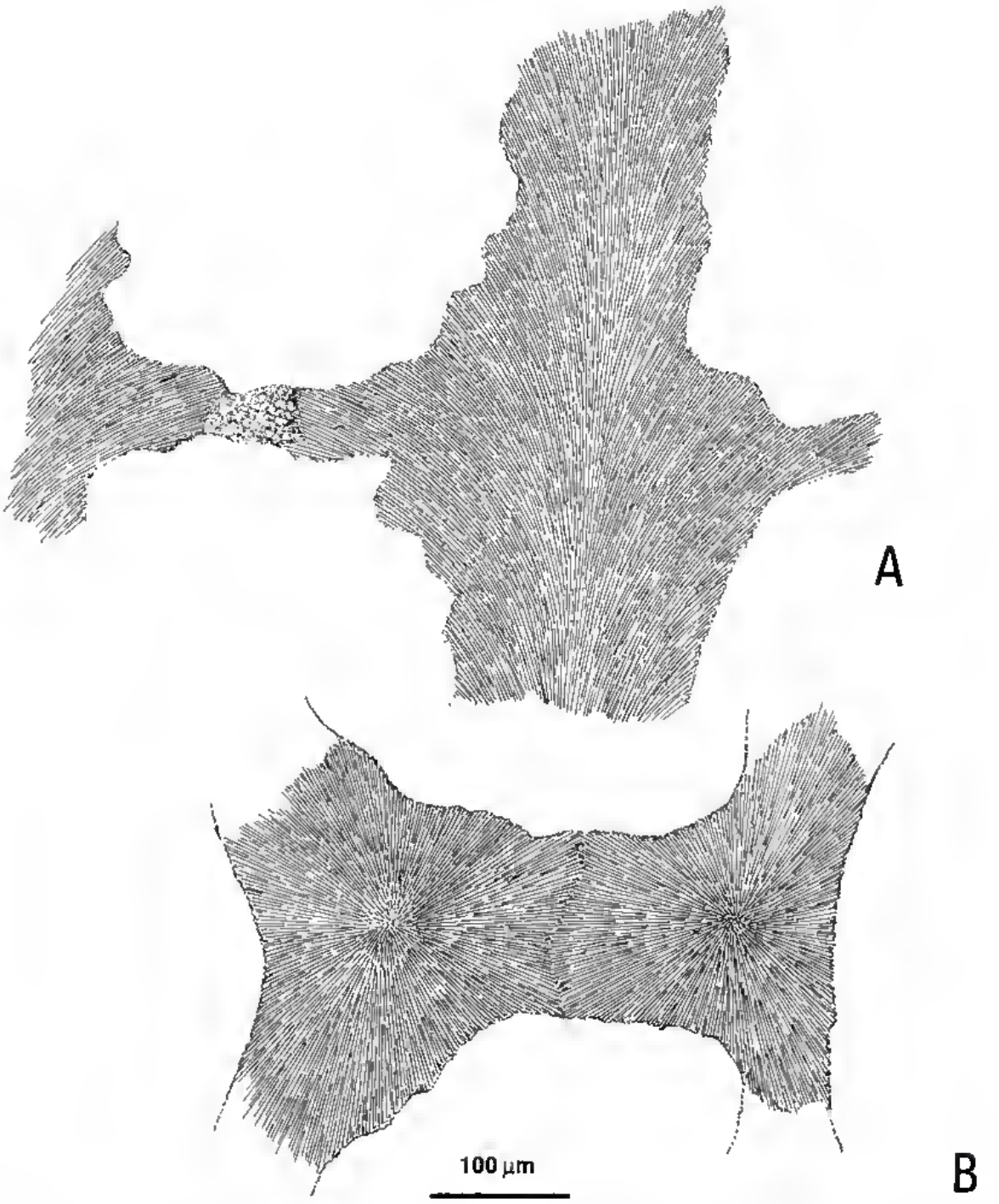

FIG. 1. — Formation des parois squelettiques et des planchers chez le Chaetétide paléozoïque *Chaetetes cylindraceus* F. De Waldheim : A, section longitudinale ; B, section transversale. Les axes des colonnes fibreuses émettent des expansions latérales (généralement trois) qui forment les parois squelettiques lorsqu'elles rejoignent les expansions issues des axes voisins.

Source : MNHN, Paris

famille (limité au Paléozoïque) par la constitution poreuse des parois. Une analyse microstructurale, conduite à partir de matériels provenant du Bathonien d'Hocqmont (collection J. C. FISCHER), a permis d'examiner les éléments de similitude avec le *Chaetetes* du Paléozoïque.

Chez les spécimens observés, le mode de réalisation des tubes s'avère très analogue à celui de *Chaetetes cylindraceus* : axes fibreux dont les éléments sont verticaux aux points de jonction des parois des tubes adjacents, et s'infléchissent latéralement jusqu'à ce qu'ils entrent en contact avec les fibres issues d'un axe voisin, sensiblement dans la région moyenne des parois des tubes (pl. III, 6).

Les planchers sont également constitués par des faisceaux infléchis horizontalement (pl. III, 5).

Cette microstructure, semblable à celle de *C. cylindraceus*, est en revanche très différente de celle des Chaetétides triasiques de Turquie qui avaient été attribués au genre *Blastochaetetes* sur la base de caractéristiques architecturales (CUIF & FISCHER, 1974).

En effet, ces formes triasiques présentent un grand nombre de centres de calcification, disposés régulièrement tout autour des tubes, selon un schéma proche de celui des Cératoporellides. Les critères microstructuraux conduisent donc à revoir leur attribution au genre *Blastochaetes*, dont la présence dans le Trias de Turquie apparaît maintenant douteuse.

CONCLUSION

Les caractères microstructuraux permettent maintenant de distinguer plusieurs lignées dans le vaste ensemble hétérogène des Chaetétides. Nos observations montrent qu'une de ces lignées pourrait inclure les genres *Chaetetes*, du Paléozoïque, et *Blastochaetetes* du Jurassique, et très vraisemblablement le genre actuel *Merlia*.

Ce genre, que l'on peut donc considérer comme un survivant d'un groupe précis de Chaetétides, posait toutefois de difficiles problèmes d'interprétation de ses caractères squelettiques. Certaines catégories spiculaires, et le squelette carbonaté lui-même, pouvant être totalement absents, on peut en déduire que cette lignée a probablement compris des formes non calcifiées, et donc non fossilisables, au cours des époques géologiques.

L'inconstance d'une partie des éléments squelettiques dans le genre *Merlia* doit cependant inciter à une certaine prudence dans la reconstitution des lignées phylogénétiques en l'absence de données sur les tissus vivants. On doit rappeler à ce sujet qu'une autre Démosponge calcifiée actuelle, *Astrosclera willeyana*, présente également une spiculation variable et qu'il apparaît assez vraisemblable que des Démosponges et des Calcarea actuelles dérivent de formes calcifiées chez qui le squelette calcaire non spiculaire aurait disparu (VACELET, 1977; 1981).

Mais on remarque également que chez *Merlia*, lorsque la minéralisation carbonatée se réalise, elle présente des caractères très constants, contrairement à ce que l'on avait supposé. Chez les *Merlia* qui possèdent un squelette calcaire, les caractéristiques microstructurales aussi bien que minéralogiques sont parfaitement stables, ce qui constitue un très fort argument pour leur utilisation taxonomique chez les formes fossiles.

Ce phénomène de biominéralisation facultative dans un groupe taxonomique est intéressant à considérer en liaison avec la répartition dans le temps des différents types de microstructures squelettiques. Les premières formes à squelette aragonitique sphérolitique,

Source : MNHN, Paris

identique à celui des *Astrosclera*, sont connues dans le Permien et dans le Trias. Puis, durant toute une période recouvrant le Jurassique et le Crétacé, ce processus de biominéralisation semble ne pas s'être réalisé. Il réapparaît dans la faune actuelle, avec des caractéristiques microstructurales strictement identiques, après une très longue phase pendant laquelle le groupe des Astrosclérides n'aurait été représenté que par des formes non calcifiées (Cuif & Gautret, 1991*b*).

Les Chaetétides de la lignée que l'on peut rattacher aux *Merlia* subissent une évolution du même type, mais leur présence dans les sédiments alterne avec celle des formes précédentes, qui sont toutes en aragonite. C'est durant des périodes considérées comme défavorables à la formation des minéralisations aragonitiques (d'un point de vue purement sédimentaire, Sandberg, 1983) que sont développées des espèces de spongiaires produisant un squelette calcitique, identique dans leur mode de formation à celui des *Merlia* actuelles. Ce sont les genres *Chaetetes* au Paléozoïque et *Blastochaetetes* au Jurassique.

Le faible développement squelettique chez les *Merlia* actuelles (lorsqu'il n'est pas complètement absent) s'explique donc bien dans cette interprétation fondée sur l'incidence des conditions externes. La période actuelle connaît un développement appréciable des formes aragonitiques (Cératoporellides, Astrosclérides et Vacelétides). Dans la faune de Démosponges actuelles, où les formes à squelette calcitique sont minoritaires, certaines *Merlia* se comporteraient donc comme les représentants de ce groupe pendant la période « aragonitique » du Permo-Trias, en n'aboutissant pas à produire une structure squelettique carbonatée.

Il est toutefois primordial de noter que l'utilisation de ces caractères microstructuraux en taxonomie et dans la reconstitution des lignées phylogénétiques repose entièrement sur la qualité des analyses microstructurales.

Ainsi doit-on actuellement éviter de réduire la caractérisation à l'un des multiples termes dont les rapports et différences sont très mal établis. La terminologie actuelle s'est mise en place de façon peu satisfaisante, soit par utilisation de termes faisant référence à des caractéristiques globales dépourvues de toute précision sur le plan de leur signification biologique (les termes « granulaires » ou « homogènes », par exemple), soit par assimilation de termes utilisés dans la description de squelettes produits dans d'autres phyla. Ainsi le terme « trabéculaire », utilisé dans l'analyse microstructurale des Cnidaires, a été assimilé à celui de « clinogonal » défini à partir de stromatopores calcitiques du Jurassique (Hudson, 1959) et également au terme « pénicillé » (Dieci *et al.*, 1974) se rapportant à des spongiaires aragonitiques du Trias. Chez les Démosponges actuelles, il est employé pour qualifier la microstructure squelettique de *Merlia*, de *Ceratoporella* et même d'une Calcarea, *Murrayona* (Wendt, 1984). Or nos observations démontrent bien que les dispositions des fibres qui constituent ces squelettes calcaires, ainsi que leurs modalités de mise en place diffèrent de manière très nette dans chacun de ces taxons. Les différences mises en évidence chez les formes actuelles sont, de plus, parfaitement corroborées par l'analyse de la répartition de ces différents types microstructuraux au cours des temps géologiques. Mais il est clair que la relation d'alternance qui s'établit entre les types aragonitiques et les types calcitiques ne pouvait ressortir que d'une analyse discriminante (Cuif & Gautret, 1991*a*), permettant de distinguer des structures squelettiques élaborées par des processus biologiques différents, et donc tout à fait aptes à fournir des arguments fiables pour la taxonomie.

Source : MNHN, Paris

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Source : MNHN, Paris

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Source : MNHN, Paris

PLANCHE I

1 — Clavidisque de *Merlia deficiens*. MEB × 1 000.
2 — Raphide épineux de *Merlia deficiens*. MEB × 6 000.
3 — *Merlia normani* : vue superficielle montrant la localisation des tigelles aux intersections des parois squelettiques. MEB × 170.
4 et 5. — *Merlia normani* : section longitudinale dans une paroi squelettique (surface polie, attaque : acide formique 5 %). Les directions de croissance des fibres et les tracés des stries d'accroissement sont bien visibles. 4 : MEB × 700. 5 : MEB × 1 400.
6 — Microstructure du squelette carbonaté de *Merlia lipoclavidisca*, identique à celle de l'espèce-type *M. normani*. MEB × 700.
7 et 8 — Mode de formation des planchers par expansion latérale des structures fibreuses issues des axes de calcification des parois (section longitudinale traitée à l'acide formique dilué). 7 : MEB × 300. 8 : MEB × 600.

Source : MNHN, Paris

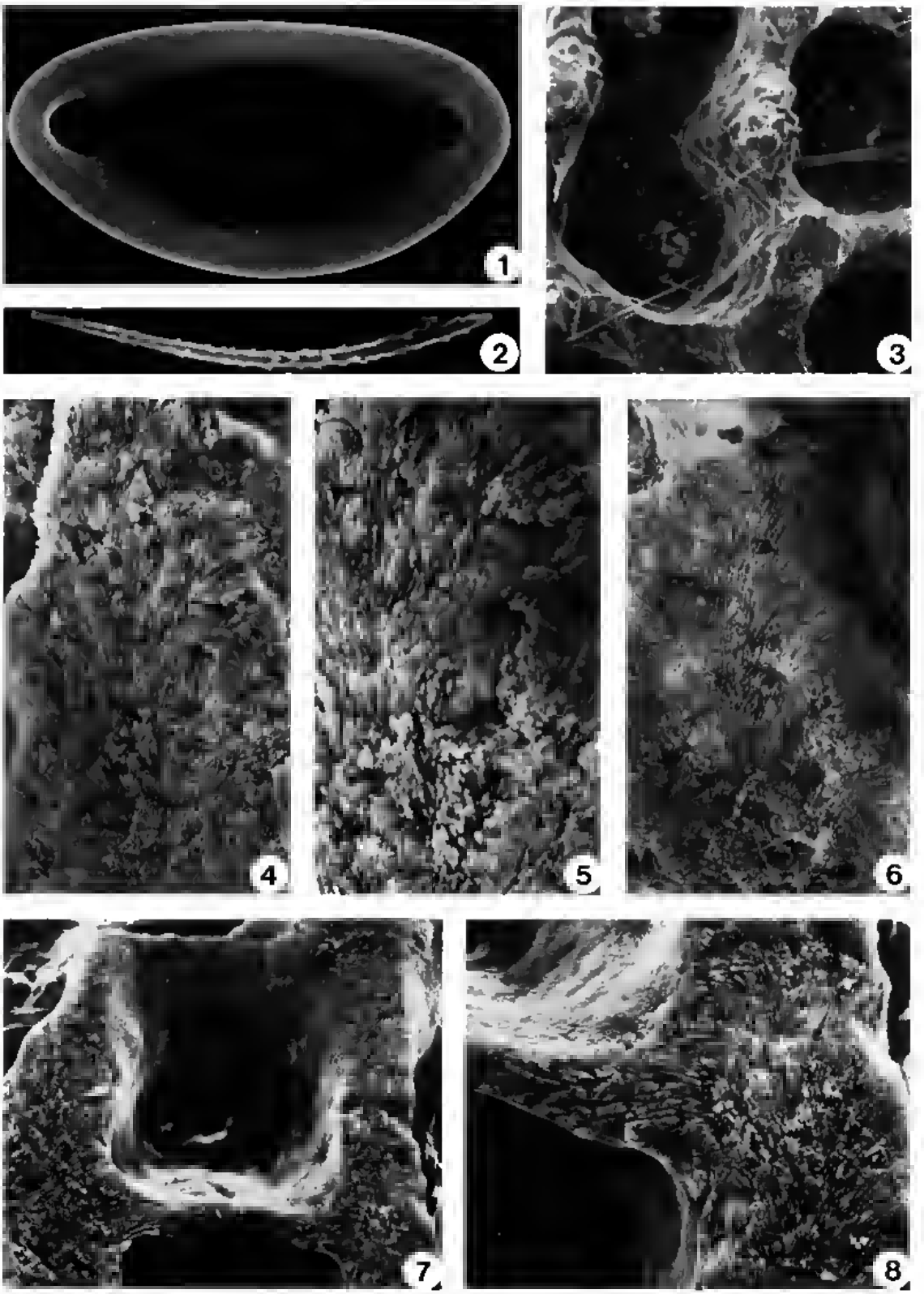

PLANCHE I

Source : MNHN, Paris

PLANCHE II

Merlia normani

1 — Plancher vu par dessus, montrant les faisceaux fibreux convergeant vers la lumière du tube, et laissant un orifice dans la partie centrale. MEB × 350.

2 à 4 — Sections transversales montrant la jonction (indiquée par les flèches sur les clichés), dans la partie médiane des parois squelettiques, des structures fibreuses issues de différents axes de calcification. 2 : Section non traitée MEB × 250. 3 : Détail de la figure précédente. MEB × 800. 4 : Surface polie traitée à l'acide formique 5 %. MEB. × 350.

5 — Partie basale d'une paroi squelettique : noter la différence d'aspect des fibres dans la zone la plus ancienne (partie inférieure du cliché). Section polie traitée à l'acide formique 5 %. MEB × 700.

6 — Détail de la partie supérieure de la figure 5 : structure finement fibreuse, recoupée régulièrement par les stries d'accroissement. MEB × 2000

7 — Détail de la partie inférieure de la figure 5 : la structure, très nettement modifiée, est grossièrement fibreuse et les stries d'accroissement ne sont plus discernables. MEB × 2000

Source : MNHN, Paris

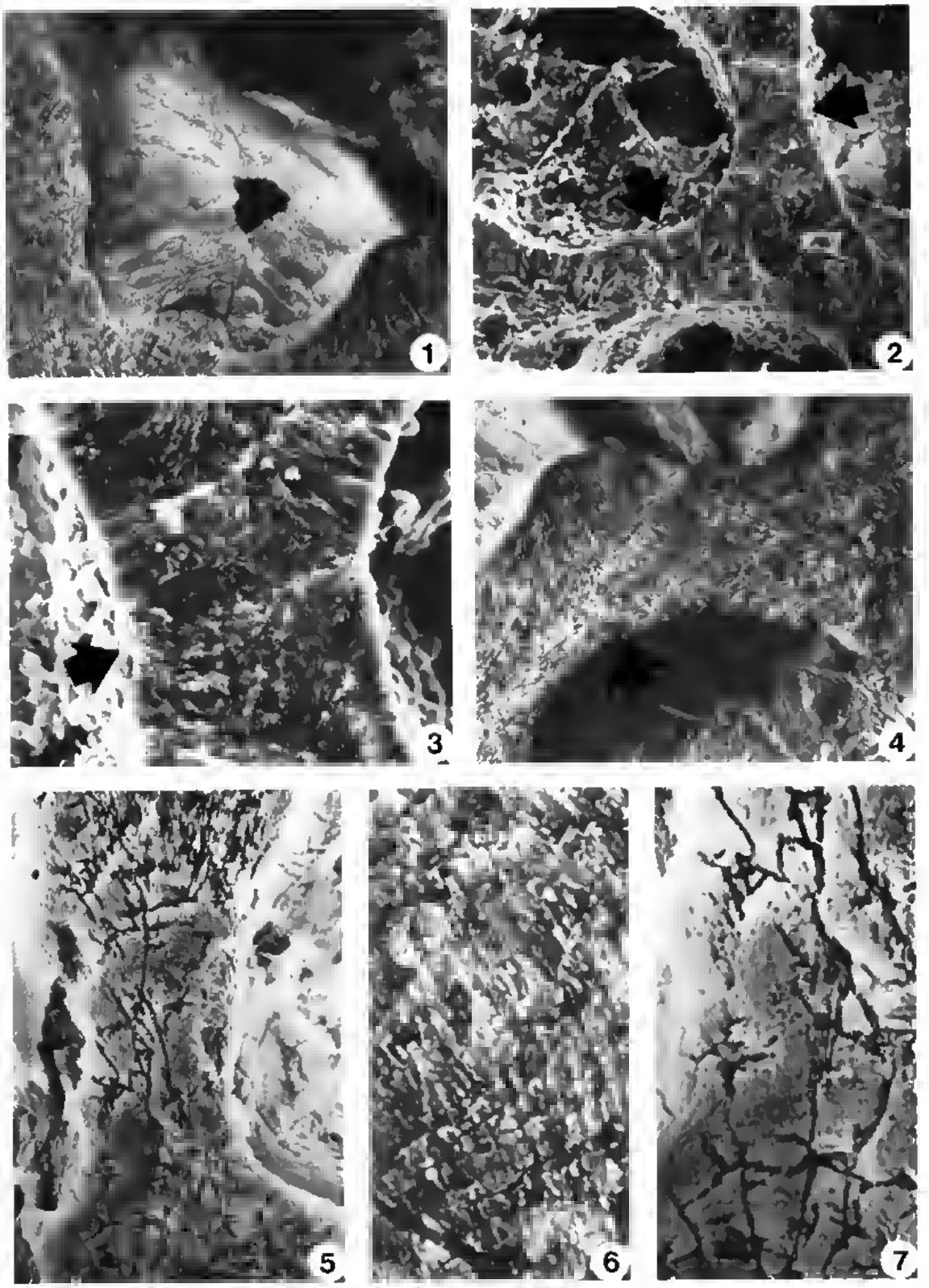

PLANCHE II

Source : MNHN, Paris

PLANCHE III

1 à 4 : *Chaetetes cylindraceus* Fischer, de Waldheim, Carbonifère de la région de Moscou.

1 — Section longitudinale (attaque : acide acétique 1 %, 5 mn) dans une paroi squelettique : les fibres, verticales dans la partie axiale des unités de minéralisation, s'infléchissent latéralement pour constituer les parois. Dans la partie médiane de la paroi (milieu du cliché) : ligne de jonction des deux unités de minéralisation. MEB × 200.
2 — Section transversale (même traitement) de la disposition illustrée sur la figure précédente. MEB × 300.
3 — Section longitudinale d'un plancher formé par l'inflexion de fibres issues des structures pariétales. MEB × 150.
4 — Plancher vu par dessus, montrant la convergence des faisceaux fibreux vers la lumière du tube. MEB × 200.

5 et 6 : *Blastochaetetes bathonicus* Fischer, du Bathonien d'Hocqmont.

5 — Section longitudinale montrant l'orientation des fibres dans les parois squelettiques et les planchers. MEB × 400.
6 — Section transversale : aucun axe de minéralisation n'est situé dans les parois, mais toujours à leur point d'intersection. MEB × 250.

Source : MNHN, Paris

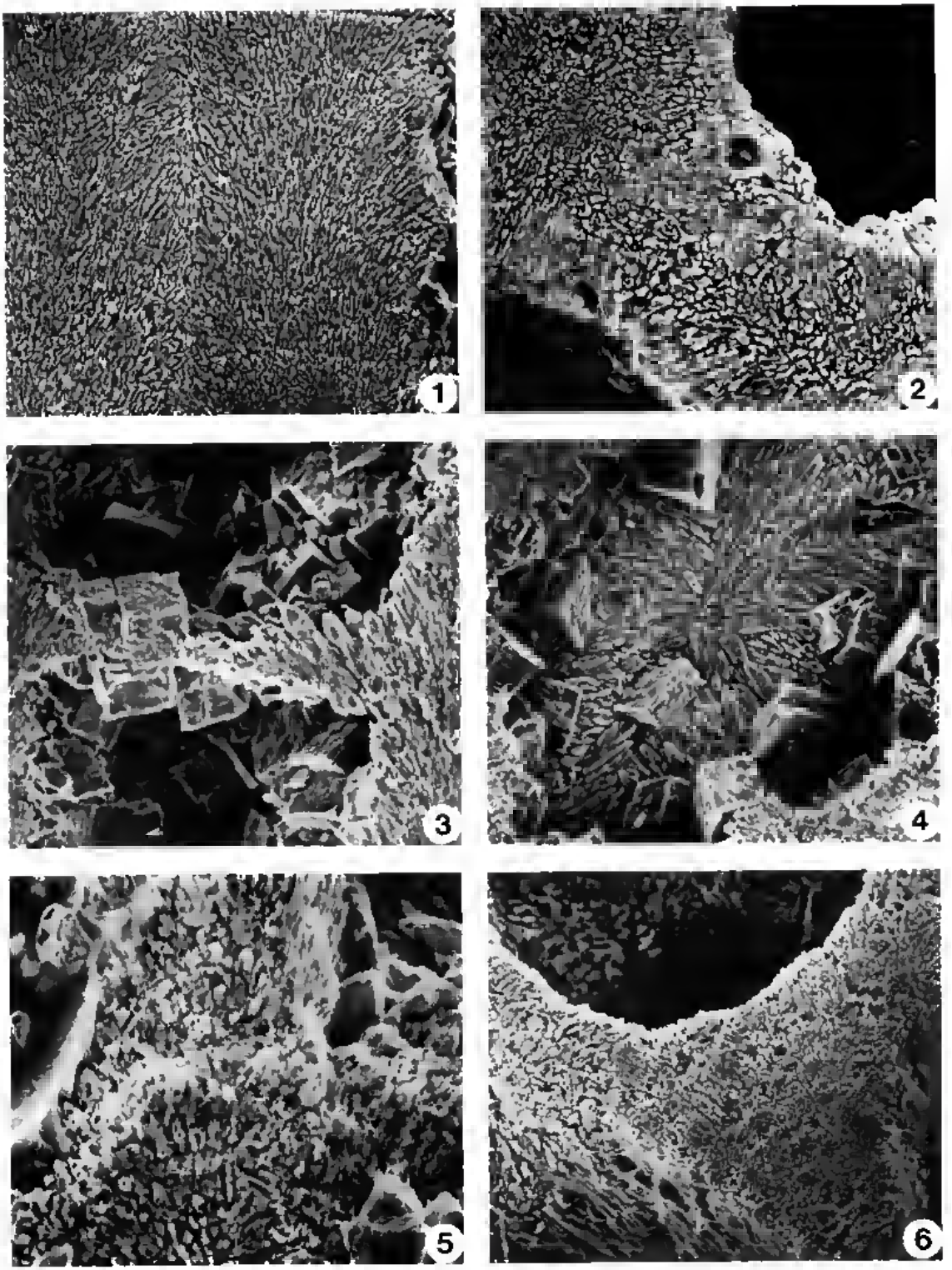

PLANCHE III

Source : MNHN, Paris

Source : MNHN, Paris

Bull. Mus. natl. Hist. nat., Paris, 4e sér., **13**, 1991,
section A, nos 3-4 : 309-349.

Haemoproteus (Haemosporidia) of lizards

par Ilan PAPERNA and Irène LANDAU

Abstract. — New species of *Haemoproteus* are described and established species are redescribed from the following reptiles (geckoes and lizards) and geographical locations : *H. simondi* (Castellani & Willey, 1904), from a slide prepared by SHORTT, deposited in the GARNHAM collection, labelled "Gecko, Osmania"; *H. mackerrasi* n. sp. from *Heteronotia binoei, H. gehyrae* n. sp. from *Gehyra australis, H. oedurae* n. sp. from *Oedura castelnaui,* all from North Queensland, Australia ; *H. underwoodsauri* n. sp. from *Underwoodsaurus milii,* South Australia; *H. ptyodactyli* n. sp. from *Ptyodactylus hasselquistii,* Cisjordan (West Asia); *H. tarentolae* (Parrot, 1927) from *Tarentola mauritanica,* Southwest France; *H. edomensis* n. sp. from *Agama stellio,* Cisjordan; *H. opluri* n. sp. from *Oplurus cuvieri* and *H.* cf. *opluri* from *Oplurus quadrimaculatus,* Madagascar. For each species is provided also data on the level of infection in the blood, its effect on the erythrocytes, the prevalence of multiple infections and the sex ratio among gametocytes. In all species studied there was an evident numerical disparity between macro and microgametocytes. The following criteria are proposed for differentiating reptilian species of *Haemoproteus* : shape, i.e. oval or halteridian shape, size and distribution of pigment and vacuoles; location in the erythrocytes and the form of nuclear displacement. Macro and microgametocytes of a same species may also differ in part or all of the above characteristics.

Key words. — *Haemoproteus*, Geckoes, *Agama stellio, Oplurus*, Australia, Cisjordan, France, Madagascar.

Résumé. — Neuf espèces d'*Haemoproteus* de Reptiles sont décrites ou redécrites chez les hôtes et dans les localités ci-après : *H. simondi* (Castellani & Willey, 1904), à partir d'un frottis de sang effectué par SHORTT, déposé dans la collection GARNHAM et étiqueté « Gecko Osmania »; *H. mackerrasi* n. sp. chez *Heteronotia binoei, H. gehyrae* n. sp. chez *Gehyra australis, H. oedurae* n. sp. chez *Oedura castelnaui,* tous provenant du Nord Queensland, Australie ; *H. underwoodsauri* n. sp. chez *Underwoodsaurus milii,* de l'Australie du Sud ; *H. ptyodactyli* n. sp. chez *Ptyodactylus hasselquistii,* de Cisjordanie (Asie de l'Ouest); *H. tarentolae* (Parrot, 1927) chez *Tarentola mauritanica,* du sud-ouest de la France; *H. edomensis* n. sp. chez *Agama stellio,* de Cisjordanie; *H. opluri* n. sp. chez *Oplurus sebae* et *H.* cf. *opluri* chez *Oplurus quadrimaculatus,* de Madagascar. Pour chaque espèce, des renseignements sur les taux des infections sanguines, l'effet du parasite sur l'érythrocyte, la prévalence des infections multiples et le sex-ratio des gamétocytes sont fournis. Dans toutes les espèces étudiées, l'inégalité numérique entre gamétocytes mâles et femelles était nette. La différenciation entre les espèces d'*Haemoproteus* repose sur les critères suivants : forme ovale ou halteridienne, taille et distribution du pigment et des vacuoles, place occupée dans l'érythrocyte et particularités du déplacement du noyau. Ces caractères varient parfois également chez les macro et microgamétocytes d'une même espèce.

Mots clefs. — *Haemoproteus*, Geckos, *Agama stellio, Oplurus,* Australie, Cisjordanie, France, Madagascar.

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Source : MNHN, Paris

Introduction

The taxonomic position of reptilian haemoproteids in relation to those of birds and mammals, as well as of the different species found in reptiles is poorly defined and sometimes contradicting. Most species descriptions, many of which were made prior to 1925, do not provide the details necessary for differential diagnosis and/or are inadequately illustrated. Type (or allotype) material for many of these species is either lacking, in a poor state of preservation or inadequately labelled. A further hindrance to our understanding of this group of parasites is the scant knowledge of their life history, thus far limited to one species (*H. metchnikovi* from terrapins, studied by de Giusti, Sterling & Dobrzechowski, 1973, Stirling & de Giusti, 1972, 1974). Differentiating *Haemoproteus* spp. from *Plasmodium* spp. by the absence in the former of merogony stages in circulating blood cells was a further source of confusion and controversy due to the fact that natural, chronic infections by *Plasmodium* consisting exclusively of gamonts cannot be distinguished from *Haemoproteus* infections (*Plasmodium/Haemoproteus* from *Agama colonorum* of Wenyon, 1909, 1915; *Plasmodium/Haemoproteus mesnili* from *Naja* spp. Bouet, 1909, Wenyon 1909; Macfie 1919; *Plasmodium/Haemoproteus gonsalezi*, Iturbe & Gonzales, 1921, Wenyon, 1926; *Plasmodium/Haemoproteus catenatus*, Pessoa & Cavalheiro, 1970, Telford, 1984).

In the present communication we describe seven new species of *Haemoproteus* and redescribe *H. simondi and H. tarentolae.*

Materials and methods

The material for this study was obtained from surveys of reptilian blood parasites and from slides of the collection of the Muséum national d'Histoire naturelle, Paris (*vide* MNHN). Captured geckoes and lizards were taken live to the laboratory. Blood was obtained by clipping the tip of the tail or the tip of the toe. Smears were air dried, fixed in methanol and stained for 1 h in diluted giemsa stain (0,8 % in phosphate buffer pH 7,2). Infected reptiles were kept alive in the laboratory in order to follow the course of the infection. The reptiles were maintained at an ambient temperature of 24°-28° C and fed on various insects. Blood examinations of the infected specimens were carried out at be-monthly or monthly intervals. Counts of the parasites' developmental stages were carried out per at least 1000 erythrocytes. At necropsy of the reptiles, smears as well as histological sections were prepared from the visceral organs. Smears were stained as above. Tissues were fixed in Carnoy's solution, then embedded in paraffin wax, and the prepared sections were stained by the Giemsa colophonium method. All recorded measurements are in microns.

Demonstration of development in a presumed insect vector was attempted by feeding laboratory bred *Culicoides nubeculosus, Culex pipiens molestus* (MNHN cultures) and *Phlebotomus papatasi* (obtained from Prof. J. A. Rioux, Laboratoire d'écologie médicale et de Pathologie parasitaire, Faculté de Médecine, Montpellier) on infected reptiles. Animals restrained in a wire cage were exposed to 24 h starved insects for overnight. Engorged insects, were dissected for the demonstration of oocysts 3-5 days later.

Source : MNHN, Paris

Abbreviations

a, macrogametocyte; cy, caryosome/s; i, microgametocyte; j, juvenile gametocyte; ja, juvenile macrogametocyte; ji, juvenile microgametocyte; N, Host cell nucleus; nz, nuclear zone; p, pigment; Py, accessory granule; t, trophozoite; VC, vacuole; VS, vesicle or cistern; v, RBC infected by *Pirhemocyton* virus; vc, vacuole in RBC induced by the viral infection; vf, virus "factory".

The following abbreviations are used in the text : L/W, length/width ratio; m, mean; n, sample size; RBC, erythrocytes. All measurements are in microns.

RESULTS

Haemoproteus simondi (Castellani & Willey, 1904) Shortt, 1922 (Figs. 1, 2)

Syn. : *Haemocystidium simondi* Castellani & Willey, 1904.

Two slides from the Garnham collection in the MNHN, numbered P 153 & P 154 and labelled : "241ZB, Gecko, Osmania (Shortt)" and "241ZB, Gecko, Osmania (Osmini?), (Shortt), Haemocystidium (Haemoproteus) simondi."

Redescription

Trophozoites were round, vesicular and 1,6-4,0 × 0,8-2,4 in size (figs. 1A, 2A, B). Young microgametocytes were absent on the slides.

Mature, 8-14 × 7-10 (m = 11,1 × 9,0; n = 13) microgamonts (figs. 1C, D, E, 2D, E) were round to oval (L/W 1,0-1,3; m = 1,1) and contained a foamy or distinctly vacuolated red cytoplasm with scattered grains of black pigment. Deep red, single or fragmented caryosomes were only detected in some of the microgametocytes.

Young, oval-shaped, 4,0-8,8 × 2,4-8,0 (n = 15) macrogametocytes (figs. 1B, 2B, C) contained a patchily stained blue cytoplasm with few to moderate amounts of black pigment granules and nuclear material consisting of a pale red halo with a deep red caryosome on its periphery.

Mature, 8,8-13,6 × 6,4-12,0 (m = 12,5 × 9,8; n = 13) macrogamonts (figs. 1F, G, H, 2F, G, H) were spherical or bean-shaped (L/W 1,0-1,58; m = 1,3) with a dense blue cytoplasm, a faint red nuclear zone with deep red caryosome and a prominent central vacuole. In some there was either one, same sized or several smaller additional vacuoles. Mature macrogamonts contained less and finer pigment particles.

Effect on the host cells : In gamont-infected RBCs nuclei were invariably displaced to a polar position but were otherwise unaltered. The RBC stroma expanded mainly laterally (m size of macrogamont-infected RBCs : 15,6 × 12,7, L/W 1,2, n = 9; m size of microgamont-infected RBCs : 17,4 × 12,9, L/W 1,4, n = 10; and m size of uninfected RBC's : 16,4 × 13,9, L/W 1,5, n = 11). Displacement of the nucleus and broadening of the stroma was also observed in RBCs infected by 2-4 trophozoites or young gametocytes (fig. 1B, 2A) :

Source : MNHN, Paris

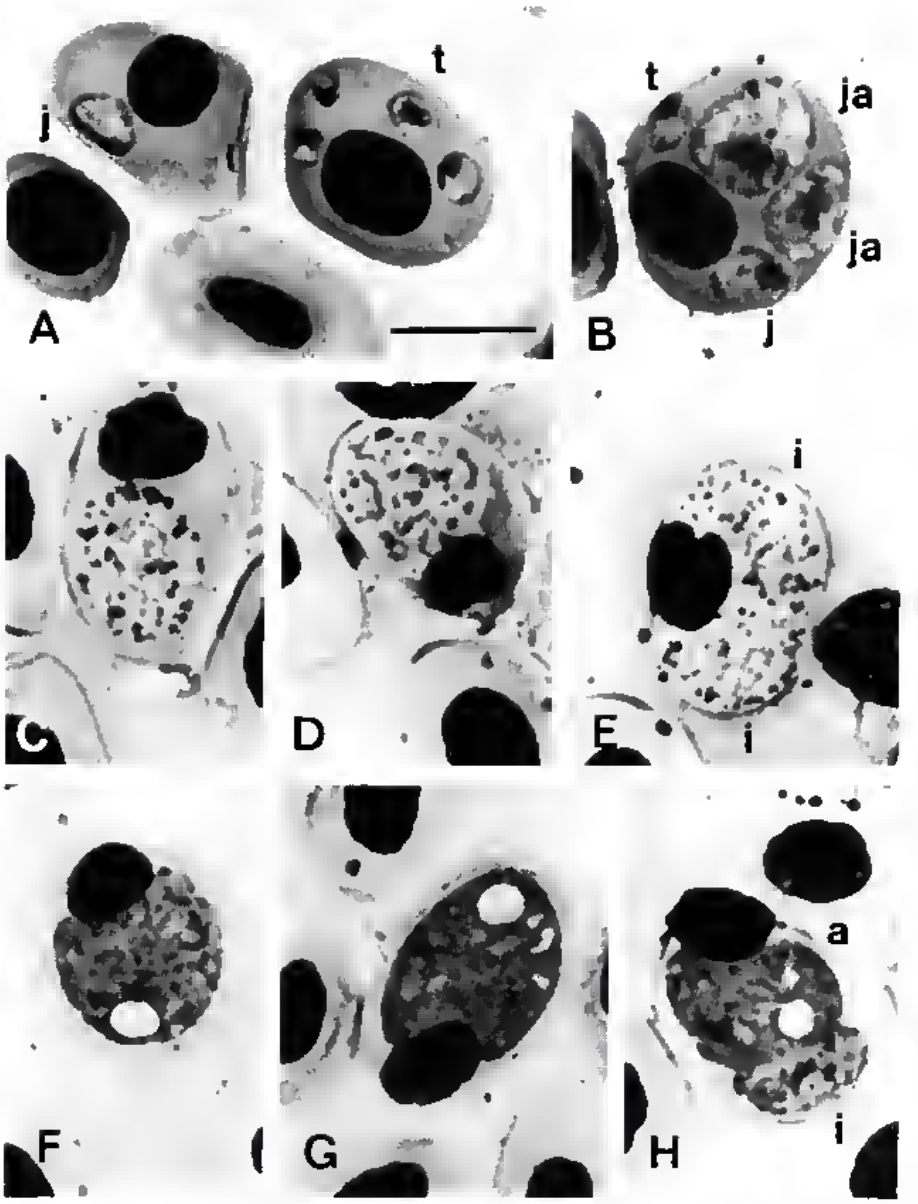


FIG. 1. — *Haemoproteus simondi* : A, trophozoites and juvenile gametocyte; B, trophozoite, juvenile gametocytes and macrogametocytes; C, D, microgametocytes; E, double infection with microgametocytes; F, G, macrogametocytes with the large vacuole; H, double infection of macro and microgametocytes. Scale = 10 μm.

Source : MNHN, Paris

trophozoite-infected RBCs of m = 15,4 × 11,4 had L/W of 1,1-1,5 (m = 1,3) while young gametocyte (< 6 × 3)-infected RBCs of m = 14,9 × 13,4 had L/W 1,0-1,3 (m = 1,1).

Level of parasitaemia, multiple infections and sex ratio : On slide P-153 mature gametocytes predominated (70 %), the other 30 % consisting of young gametocytes and trophozoites. The overall level of parasitaemia was 2,5 %, and multiple infections (fig. 1H) occurred in 21 % of the infected RBCs. Slide P-154 contained predominantly trophozoites (94 %), the rest being young gametocytes. The overall level of parasitaemia was 19 %, and the rate of multiple infections was 34 %. Trophozoites occurred in multiple infection at a rate of up to five per RBC (figs. 1A, B, 2A, B). Invasion of the RBCs was not simultaneous since

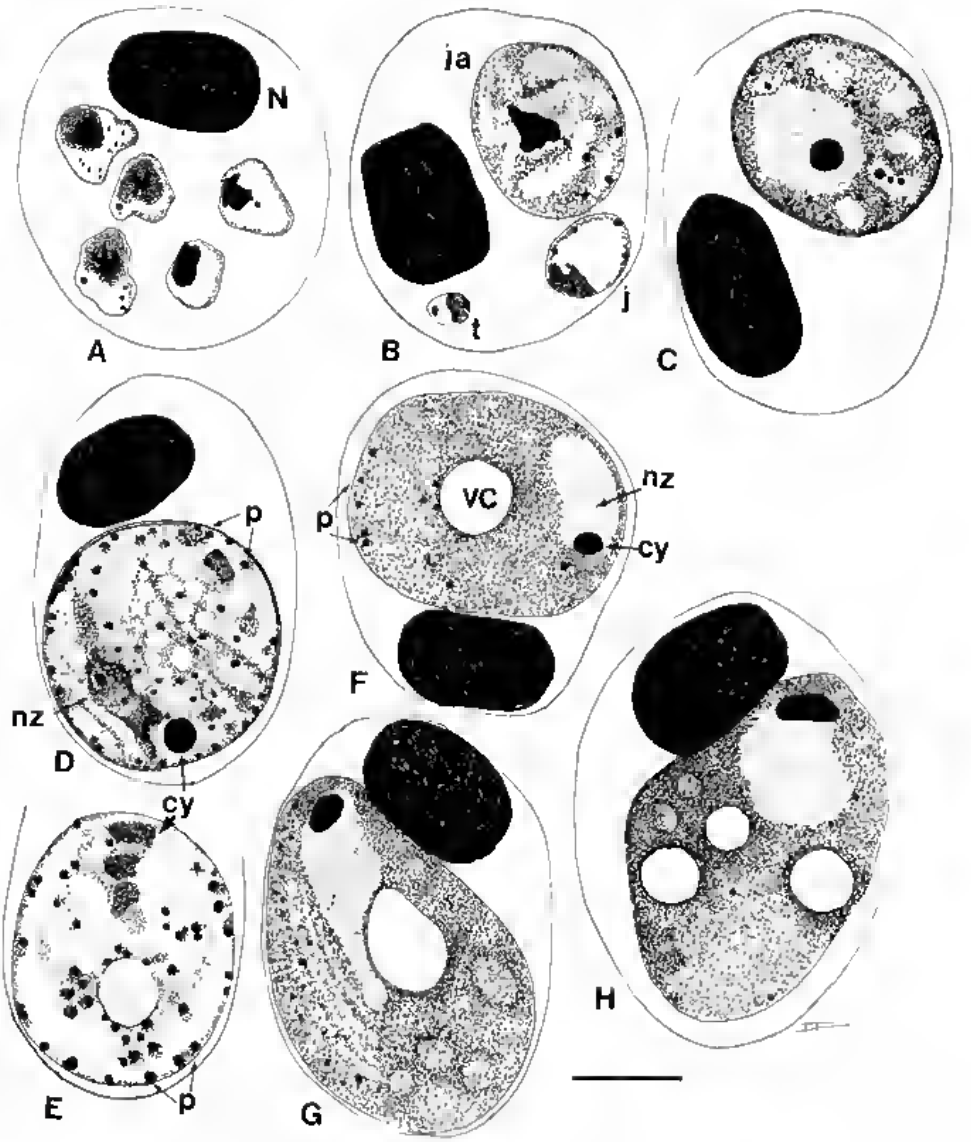


FIG. 2. — *Haemoproteus simondi* : A, trophozoites; B, trophozoites, juvenile gametocyte and macrogametocyte; C, juvenile macrogametocyte; D, E, microgametocytes; F-H, macrogametocytes. Scale = 4 µm.

Source : MNHN, Paris

these trophozoites also occurred with later stage parasites. Young macrogametocytes occurred in multiple infections at a rate of up to three per RBC. The ratio of micro to macrogametocytes was 1 : 2,1 (1 : 1,2 for mature alone).

Taxonomic evaluation

Garnham account (1966 : 952-955) and illustrations (plate LXXXVI, 2-8, facing p. 787) of *H. simondi* gametocytes is apparently based on slides P-153, P-154, referred to in his text on p. 953 as "new Indian material" from Hyderabad, in "probably *Hemidactylus brookei*". This is the same host species from which Shortt (1962) described exoerythrocytic merogony. This *Haemoproteus* seems to be conspecific with *H. dimondi* described by Castellani & Willey (1904) and later by Dobell (1910) from *Hemidactylus leschenaulti* from Ceylon. Macrogametocytes of both Indian and original Ceylonese specimens have a central large vacuole. This vacuole occurring only in the macrogametocytes is a conspicuous diagnostic characteristic of *H. simondi.*

HAEMOPROTEUS OF AUSTRALIAN GECKOES

"*Haemocystidium simondi*", described by Mackerras (1961) from four species of geckoes, *Heteronotia binoei, Gehyra variegata, Oedura tryoni* and *Phyllurus platurus*, appears to represent two or more different species : oval, rounded (from *H. binoei, G. variegata* and *P. platurus*) and halteridium-like (from *O. tryoni*). None of these are conspecific with *H. simondi* described by Castellani & Willey (1904). We identified an oval, rounded species from the *H. binoei* and *Gehyra australis* that we examined which appear to be conspecific with the ones reported by Mackerras (1961) from *H. binoei* and *G. variegata*, respectively. We also found two distinct halteridian forms, both reminiscent of the one described from *O. tryoni.*

Haemoproteus mackerrasi n. sp.

(Figs. 3, 4)

Syn. : *Haemocystidium simondi* Mackerras, 1961 of *H. binoei.*

Host : *Heteronotia binoei* Gray, 1845.

Locality : Dry woodland on the outskirts of Townsville, North Queensland (type locality), Mornington Is. in the Gulf of Carpenteria, Queensland (Mackerras, 1961).

Type specimen : On slide 145EB deposited in the MNHN.

Description

The smallest detectable trophozoites was 2,4 × 2,0 in size (fig. 3A). Young gametocytes, 5,6 × 4,8 could already be differenciated by cytoplasm staining into micro and macrogametocytes (figs. 3A, C). Some gametocytes had small vacuoles (fig. 3B). Young microgametocytes

Source : MNHN, Paris

(5,4-7,2 × 3,2-4,8) were usually rounded (L/W 1,16-2,25, m = 1,62, n = 4), with an excentric caryosome and a few fine pigment granules. Microgametocytes, 7,2-11,2 × 4,0-7,2 (m = 7,7 × 5,3 ; n = 12) (figs. 3D, E, J, K, M, 4A, D, E) were predominantly round/oval (L/W 1,0-2,2 ; m = 1,6 ; 75 % < 2, 25 % > 2) with variable density red, foamy or with variable number of small vacuoles cytoplasm and a somewhat denser red nuclear zone which contained one large (0,5-1,0), usually distinct, caryosome (fig. 4J). Pigment granules were fine and randomly scattered.

Microgametocytes exflagellated (figs. 3N, O) in heparinized blood left in a vial at room temperature (20-24° C) for 24 hours.

Young macrogametocytes, 5,4-9,6 × 4,0-8,0, were predominantly round (L/W 1,0-2,4 ; m = 1,43 ; n = 6), and contained a few pigment granules along their margins. Macrogametocytes 9,6-16,8 × 5,6-12,0 (m = 13,7 × 8,4 ; n = 12) in size were variable in shape (L/W 1,1-2,8 ; m = 1,8 ; 58 % < 2 ; 42 % > 2) (figs. 3C, E-J, L, M). In some instances macrogametocytes occupied the entire RBC cytoplasm (fig. 4K). The macrogametocyte cytoplasm stained deep blue and was without large vacuoles. A large, dense red caryosome was usually present and was located within or alongside the red nuclear zone. The pigment consisted mostly of fine granules with very few coarser grains, both randomly scattered (figs. 4B, C, E-I). Some mature macrogametocytes had undulating margins (fig. 4E).

Effect on the host cells : Infected RBCs were either only slightly enlarged or not at all. Mean size of uninfected RBCs was 18,4 × 10,8 (n = 14) ; size of infected cells ranged from 17,6-19,6 × 10,4-11,6. Heavy multiple infections had a variable effect, with some of the RBCs becoming enlarged or deformed (expanded : 19-21 × 13-17 or elongated, up to 24 × 10 (fig. 4D, H)). In most infected RBCs, including those with multiple infection, the nucleus retained its central positions, if the nucleus was displaced then it was usually laterally, and only exceptionally to a polar position (figs. 3C-F, J, M, 4D, G, H).

Prevalence of infection, multiple infections and sex ratio : In the Townsville area, infection was found in only one *H. binoei* out of 29 examined in 1986, and none in 30 examined in 1988. Mackerras (1961) reported infections in three out of seven *H. binoei* examined in Mornington Is. The level of parasitaemia in the captured gecko from Townsville was 38 %. Young and mature microgametocytes frequently formed multiple infections with other microgametocytes (in 28 % of the infected RBCs, up to five per RBC) or with macrogametocytes (1-4 per RBC, with 1-2 macrogametocytes). Multiple infections of macrogametocytes alone were rare, being found in less than in 2 % of the infected RBCs. The sex ratio was 1,4 microgametocytes per macrogametocytes.

Taxonomic evaluation

Both micro and macrogametocytes of *H. mackerrasi* are predominantly round-type *Haemoproteus*, like *H. simondi* but differ from the latter in that their macrogametocytes lack a large central vacuole and the microgametocyte pigment granules are fine rather than coarse. *H mackerrasi* is also readily differentiated from the other round species, *H. grahami* (Shortt, 1922), *H. kopki* (de Mello, 1916), and *H. tarentolae* (Parrot, 1927), which in part also form halteridian macrogametocytes and contain one or numerous conspicuous vacuoles and/or aggregated coarse pigment.

Source : MNHN, Paris

Differentiation is more difficult between gametocytes of *H. mackerrasi* and *H. gehyrae*. In the latter, microgametocytes have two endosomal, aggregated caryosomes and an accessory red granule (or "polar granule") both of which are lacking in *H. mackerrasi*. Macrogametocytes of *H. gehyrae*, unlike those of *H. mackerasi*, invariably displace the RBC nucleus to a polar position.

Haemoproteus gehyrae n. sp.
(Figs. 5, 6)

HOST : *Gehyra australis* Gray, 1845.

LOCALITY : Woodland on the outskirts of Townsville, North Queensland.

TYPE SPECIMEN : On slide 149EB deposited in the MNHN.

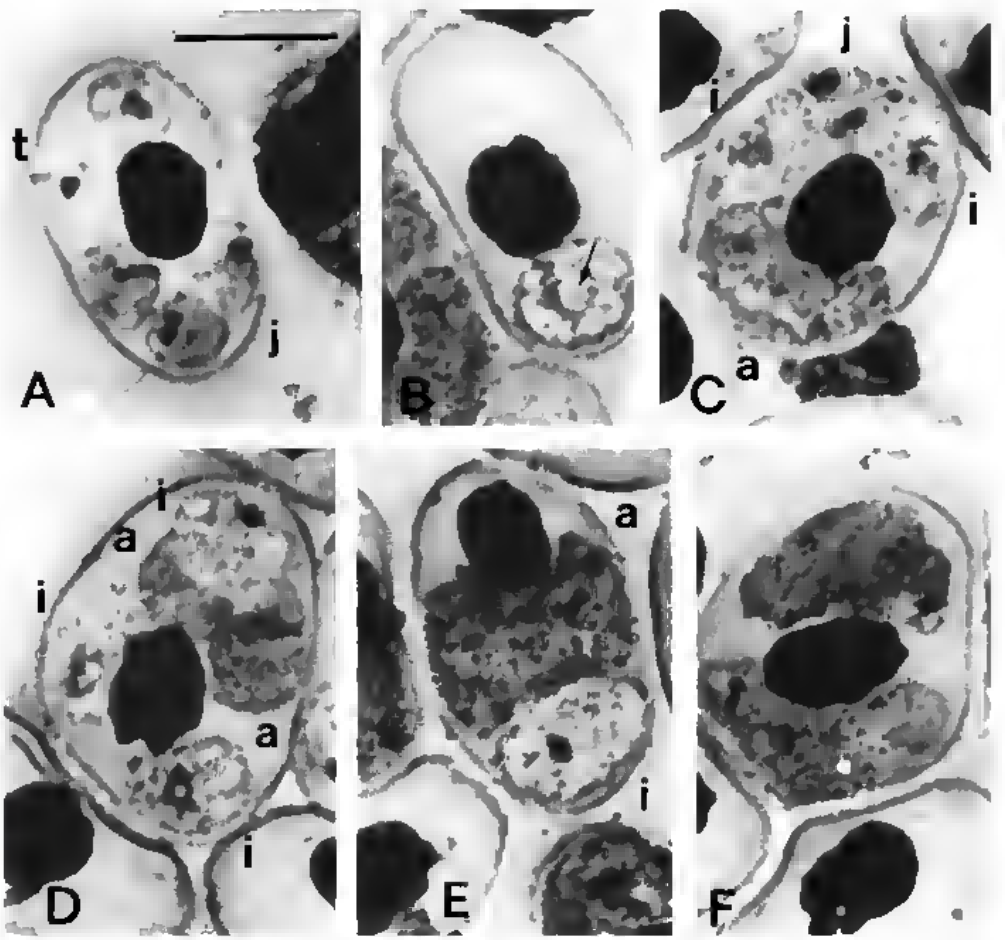
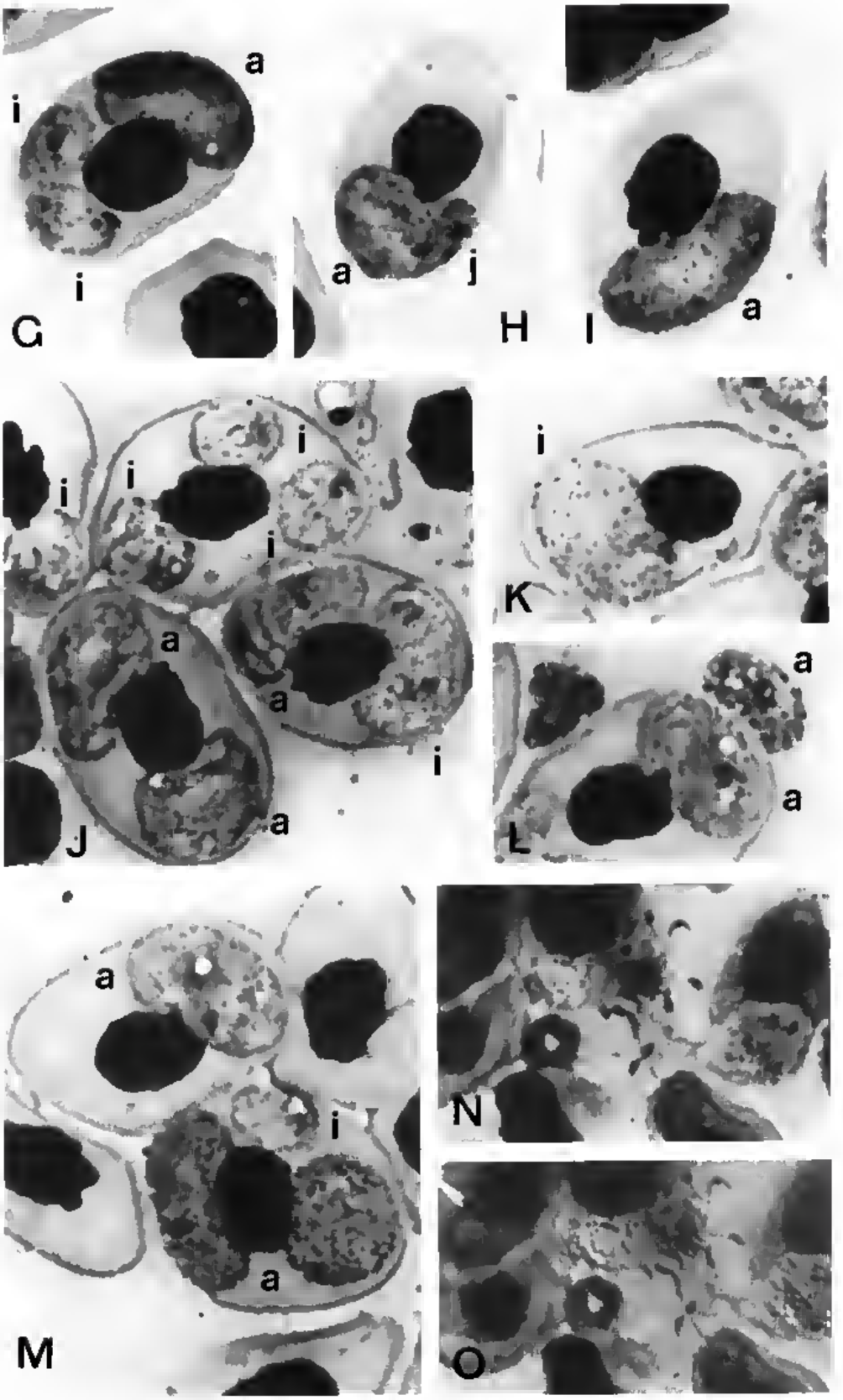


FIG. 3. — *Haemoproteus mackerrasi* n. sp. : A, mixed infection : trophozoites and juvenile gametocytes; B, young microgametocyte with central vesicle (arrow); C-M, single and multiple infections with juvenile and mature gametocytes, note (in L) evicted macrogametocytes, N, O, exflagellation of microgametocytes (N : direct illumination, O : Nomarski interference illumination) Scale = 10 µm.

Source : MNHN, Paris



Source : MNHN, Paris

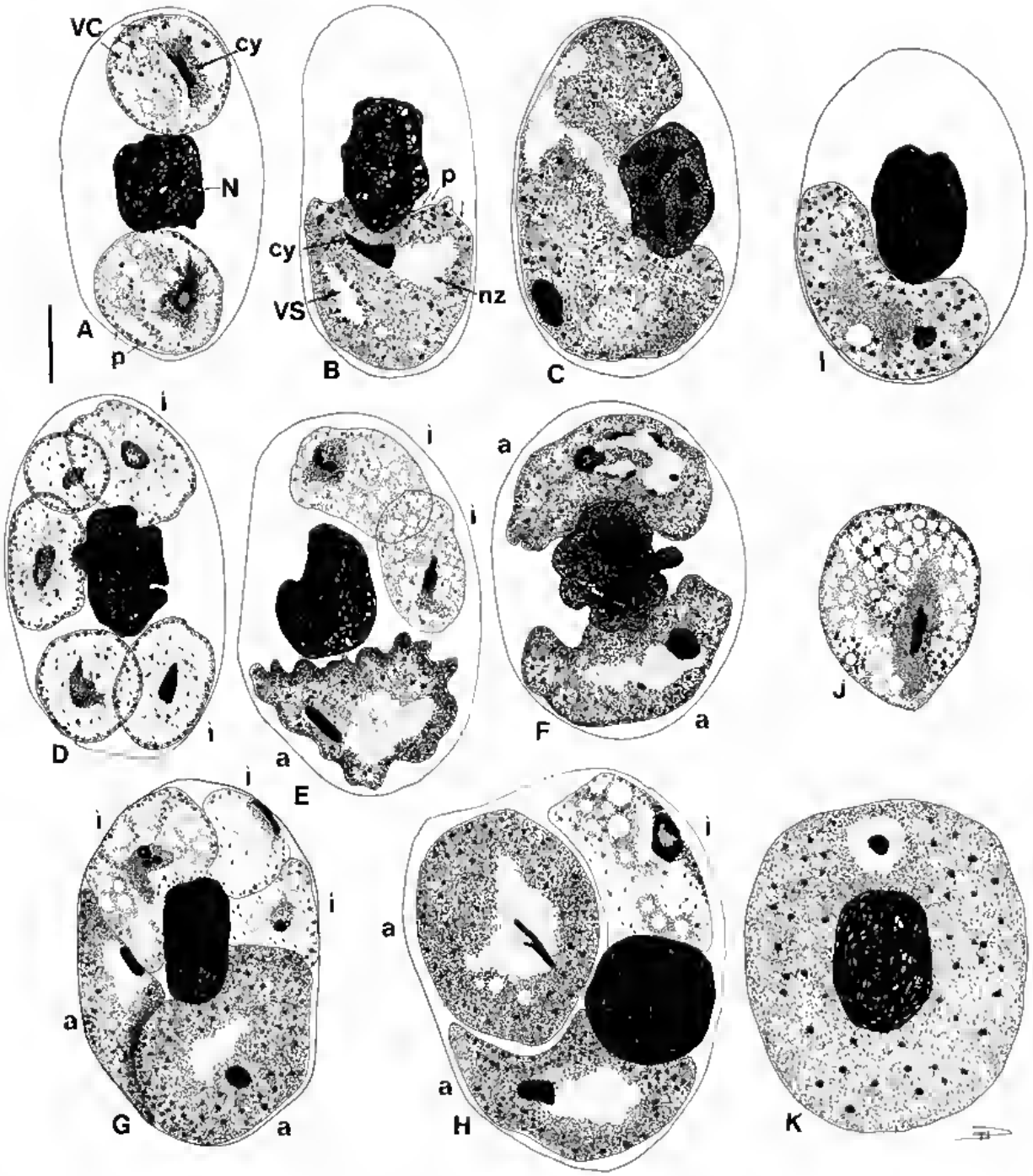


FIG. 4. — *Haemoproteus macherrasi* n. sp. : A, double microgametocyte infection ; B, C, I, macrogametocytes ; D-H, multiple infections with micro and macrogametocytes ; J, evicted microgametocyte ; K, large macrogametocyte displacing the entire RBC's cytoplasm. Scale = 4 μm.

Source : MNHN, Paris

Description

Trophozoites, 4,0-4,8 × 1,2-1,6 in size (fig. 6E) and young gametocytes, 5,0-5,5 × 2,0-4,5 (fig. 6F), were only seen in a few instances and in small numbers. Both young stages had an unstained center (extracted vacuole ?) and a peripheral zone of blue-staining cytoplasm which contained also red chromatin.

Both small and large microgametocytes (fig. 5A), 6,0-12,0 × 3,6-10,4, were round-shaped (L/W 5 % > 2,0; 95 % < 2,0; m = 1,33; n = 46). Differences between young and mature microgamonts were only in size (young : 4,8-8,0 × 3,6-5,6; n = 17; and apparently mature : 7,2-12,0 × 4,8-10,4; m = 9,8 × 7,6; n = 22). All had a faintly pink cytoplasm usually with two large, distinct deep red-staining, centrally positioned bodies — the caryosome and an "accessory granule" (figs. 6B, C, D, J). Fine pigment granules were usually evenly scattered, but sometimes aggregated. Some had faint outlines of a centrally located vacuole.

Young macrogametocytes, 5,4-9,6 × 4,0-8,0, were predominantly oval (L/W 1,1-1,7; m = 1,37; n = 10). Macrogametocytes were 9,0-14,4 × 4,0-9,6 (m = 10,5 × 7,4; n = 43) in size, with a m L/W of 1,75 (75 % round, L/W < 2, figs. 5A-E; 25 % elongated, L/W 2,0-3,1, figs. 6E, H); a few developed into long 19,2-25,6 × 4,0-7,2 (L/W 3,4-4,8) halteridia which folded over themselves in the infected RBC (figs. 5A, 6G). Macrogametocyte blue cytoplasm contained a scattered zone or bands of red nuclear material and a conspicuous or disaggregated caryosome (figs. 6A, B, I). The pigment granules were usually uniform in size and evenly scattered within the cytoplasm (figs. 5D, E). In some, pigment also aggregated into coarser granules.

Effect on the host cells : Infection caused RBCs to increase in size, distorted their shape and displaced the nucleus; most extreme changes occurred in multiple infections by three or more gametocytes. Mean size of uninfected RBCs was 16,2 × 8,7 (L/W 1,9; n = 23); infected with a single microgametocytes — 16,3 × 8,9 (L/W 1,8; n = 5); with many microgametocytes — 1,88 × 10,6 (L/W 1,7; n = 16); with one or more macrogametocytes — 1,83 × 10,9 (L/W 1,6; n = 18); and with micro and macrogametocytes — 17,6 × 9,7 (L/W1,8; n = 8). Extreme enlargement and distortions were observed in some individual cells infected with three and four microgametocytes (18 × 18; 20 × 10; 21 × 13) and also RBCs infected with one or two macrogametocytes (19 × 11,14; 20 × 12). A concurrent infection with *Pirhemocyton* caused atrophy as well as additional disfiguration of the RBC (figs. 5A, D). The m size of the RBC infected with only *Pirhemocyton*, at its latest stage (fig. 5C), was reduced to as low as 13 × 10 (L/W 1,3; n = 10). Such cells, however, were somewhat larger when being infected with *Haemoproteus* (14,6 × 9,5; L/W 1,52; n = 9) (figs. 6I, J). Macrogametocytes frequently caused displacement of the RBCs nucleus to a polar or lateral position. Single microgametocytes usually did not affect RBC nucleus' position, while in multiple infections the extent and direction of the nuclear displacement depended on the position of the gametocytes in the RBC (figs. 5A, E, 6A, C, G).

Prevalence of infection, multiple infections and sex ratio : In the Townsville area, infection was found in one out of the 19 *G. dubia* studied in 1986, and in none of the 15 studied in 1988. The infected gecko was maintained in captivity under observation from August 1986 to July 1987. The level of parasitaemia in August 1986 was 45 %, reaching 57 % in October and

Source : MNHN, Paris

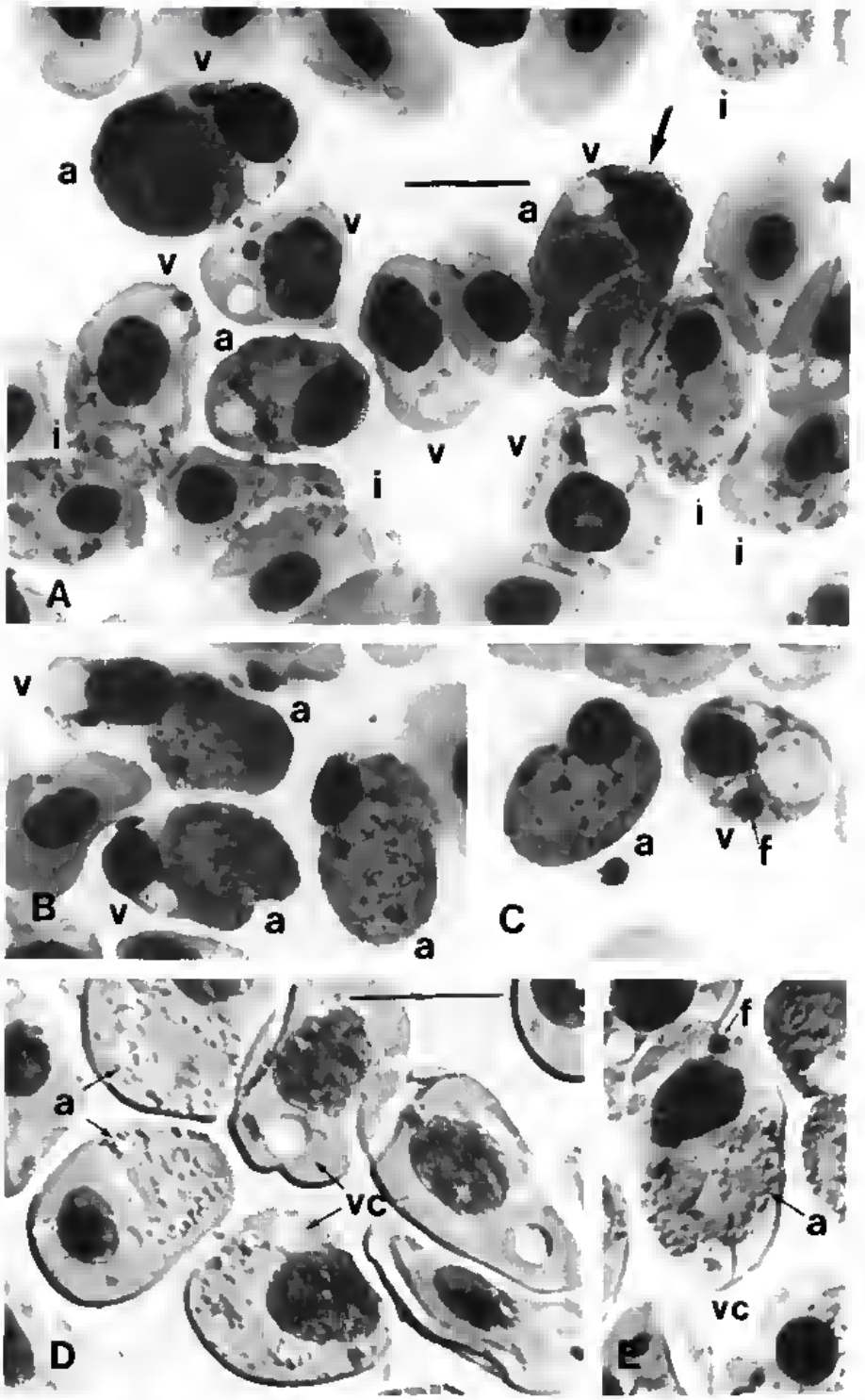


FIG. 5. — Mixed infection of *Haemoproteus gehyrae* n. sp. and *Pirhemocyton* virus : A-C, direct illumination, arrow : RBC containing long, folded macrogametocyte; D, E, Nomarski interference illumination. Scale = 10 µm.

Source : MNHN, Paris

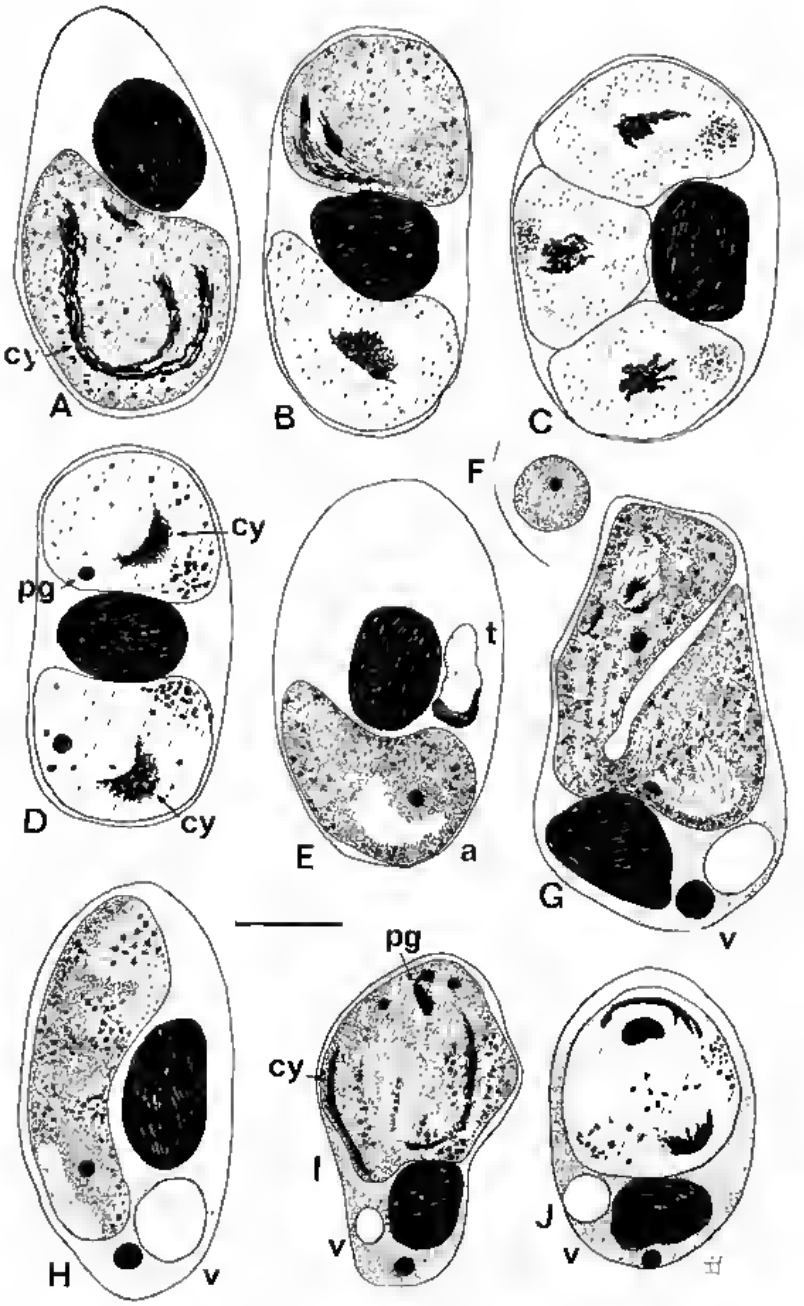


FIG. 6. — *Haemoproteus gehyrae* n. sp. : A-F, 1-3 months after host capture : A, macrogametocyte; B, micro and macrogametocytes; C, D, multiple microgametocyte infections; E, macrogametocyte and trophozoite; F, juvenile macrogametocyte; G-J, 4-5 months after host capture, infection superimposed by *Pirhemocyton* virus : G, large folded macrogametocyte; H, halteridium-like macrogametocyte; I, oval macrogametocyte; J, microgametocyte. Scale = 4 μm.

Source : MNHN, Paris

gradually declining until mid-January 1987 to 23 %. In December-January, a *Pirhemocyton* virus infection appeared in the gecko, infecting 38 % of the blood RBCs in December and 16 % by mid January. During this time, 49-60 % of the RBCs infected by *Haemoproteus* in December and 12 % in January were simultaneously infected with the virus (figs. 5A, D). The end of the viral infection in March, coincided with a sharp decline in the level of parasitaemia by *Haemoproteus*, to less than 2 %. The infection then gradually declined to below 0,7 % in July, when the gecko died. Throughout the period of observation trophozoites occurred only once, in October, when the parasitaemia was at its climax. Multiple infections with same sex and opposite sex gametocytes, as well as with trophozoites and immature gametocytes, were common (22-46 %) during the phase of high parasitaemia, and became less frequent (8-20 %), or altogether absent with the overall decline in the level of parasitaemia. Double infections were most common, while the frequency of multiple infections (3-5) particularly of microgametocytes were less common (3-8 % of the total number of multiple infections). Throughout the observed period of parasitaemia, microgametocytes outnumbered macrogametocytes. Three times however, at high parasitaemia, microgametocyte numbers came close to parity with macrogametocytes (1,02-1,2 : 1). Otherwise the disparity was on the order of 1,4-11 microgametocytes per macrogametocyte.

Taxonomic evaluation

Mackerras (1961) recorded an infection by *H. simondi* in one of 12 examined *G. variegata* from Mornington Is. in the Gulf of Carpenteria. In this habitat, however only *G. australis* is found (S. Donnellan, South Australia Museum, personal communication), and the recorded parasite might well be conspecific with the species described here.

In size and in many of its structural details *H. gehyrae* is very similar to *H. mackerrasi*. However, *H. gehyrae* microgametocytes frequently have a pair of large, deep red staining chromatin bodies (caryosome and "accessory granule"), while *H. mackerrasi* invariably contains a single chromatin body (a caryosome). In *H. gehyrae* — infected RBCs the nucleus is always displaced, frequently to a polar position, while in *H. mackerrasi* nuclear displacement is exceptional.

Gametocytes of *H. gehyrae* are indistinguishable from the plasmodiid *Billbraya australis* found in the gecko *Phyllodactylus marmoratus* in South Australia (Paperna and Landau, 1990). In this species merogony was only seen in the first three weeks following capture while in the remaining five month of follow-up, the infection consisted entirely of gamonts. In *G. australis*, during 10 months of repeated blood examinations, trophozoites were observed only once, and dividing merogony stages were never found. Data from additional infected *G. dubia* are needed for a conclusive evaluation of the relationship between the parasites of the two geckoes.

Source : MNHN, Paris

Haemoproteus oedurae n. sp.
(Figs. 7, 8)

HOST : *Oedura castelnaui* (Thominot, 1889).

LOCALITIES : Dry woodland on the outskirts of Townsville and in Fletcher View, 15 km east of Charter Towers (141 km east of Townsville) North Queensland.

TYPE SPECIMEN : On slide 153EB deposited in the MNHN.

DESCRIPTION

The smallest observable trophozoites were round, 1,2-2,0 × 0,8-1,2 in size, with an unstained center or vacuole, a peripheral zone of blue-staining cytoplasm and a red nuclear zone (figs. 8A, B, C, a, b). On-growing trophozoites, 2,4-6,4 × 0,8-4,4 in size gradually became elongated, reduced their unstained central zone and accumulated fine pigment granules (figs. 7A, B, 8A, B, C, b). Immature gametocytes, still sexually undifferentiable, 4,0-8,0 × 1,2-4,0 in size, were already assuming a halteridium form (m L/W : 3,2; n = 9). Their patchy blue-pink cytoplasm contained a large nuclear zone and a fair amount of fine granules of black pigment (figs. 7B, 8C, c, f). Small, "young" microgametocytes, 8,0-13,6 × 1,6-6,4 in size (figs. 7B, C, 8D, g, h, i), and large mature microgametocytes, 8,0-20,0 × 2,8-9,6 (figs. 7D, E, 8G, H, I, M) were predominantly halteridia like (young L/W 1,6-5,0, mean = 3,0, n = 14; mature L/W 1,2-5,5, mean = 3,1, n = 20), and located lateral to the RBC's nucleus. A few developed into round forms (L/W < 2,0 : 20 % of the young and 28 % of the mature) and occupied a polar position in the RBC (figs. 7E, F, 8F). Microgametocytes' pink cytoplasm contained a red staining nuclear zone and several scattered chromatin granules, as well as scattered fine and coarse pigment granules. The smaller microgametocytes sometimes contained one or two very large vacuoles (fig. 8j). The cytoplasm of the larger microgametocytes stained more intensely and contained one to several round (about 0,8 in diameter) vacuoles (fig. 8H).

Macrogametocytes' blue-staining cytoplasm contained a scattered, red nuclear zone, one, or exceptionally, two chromatin bodies (caryosome and accessory granule) within or at the border of the nuclear zone, and randomly dispersed, usually fine, pigment granules. Young (figs. 7C, 8E, K, d, e) as well as mature (figs. 7G-L, 8N-P) macrogametocytes were predominantly halteridium-shaped and were located alongside the RBC's nucleus (young L/W : 1,6-5,0; m = 3,0, n = 14; mature L/W : 1,3-5,5; m = 2,7, n = 48); 14 % of the young and 23 % of the mature macrogametocytes developed into a round form (L/W < 2,0) and were located in a polar position in the RBC. Presumably mature macrogametocytes, 13,6-21,6 × 3,2-11,2 (m = 18,0 × 6,8; n = 43) differed from young forms, 8,0-13,6 × 2,4-6,4, in that they have variable number of 0,8-1,0 in diameter vacuoles at both ends. Some of the larger macrogametocytes accumulated coarser pigment granules and exceptionally formed discrete aggregates.

Effect on the host cells : Infected RBCs with single and double gametocyte infections became enlarged, while the nucleus either remained central, was laterally displaced (figs. 7H, I,

Source : MNHN, Paris

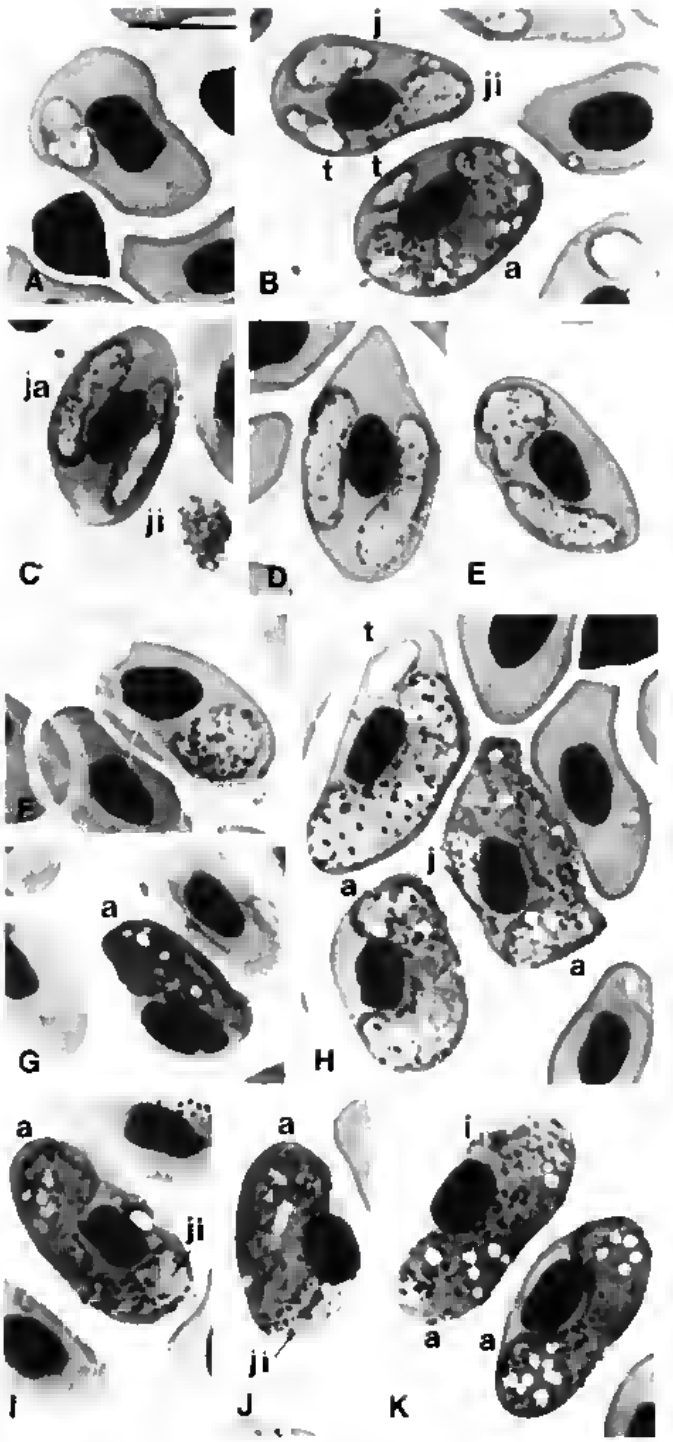


FIG. 7. — *Haemoproteus oedurae* n. sp. : A, juvenile gametocyte; B, multiple infection with trophozoites, juvenile microgametocyte and mature macrogametocyte; C, juvenile micro and macrogametocytes; D, E, microgametocytes; F, oval microgametocyte; G, sub-mature macrogametocyte; H-K, mature macrogametocytes accompanied by trophozoites and juvenile gametocytes. Scale = 10 μm.

Source : MNHN, Paris

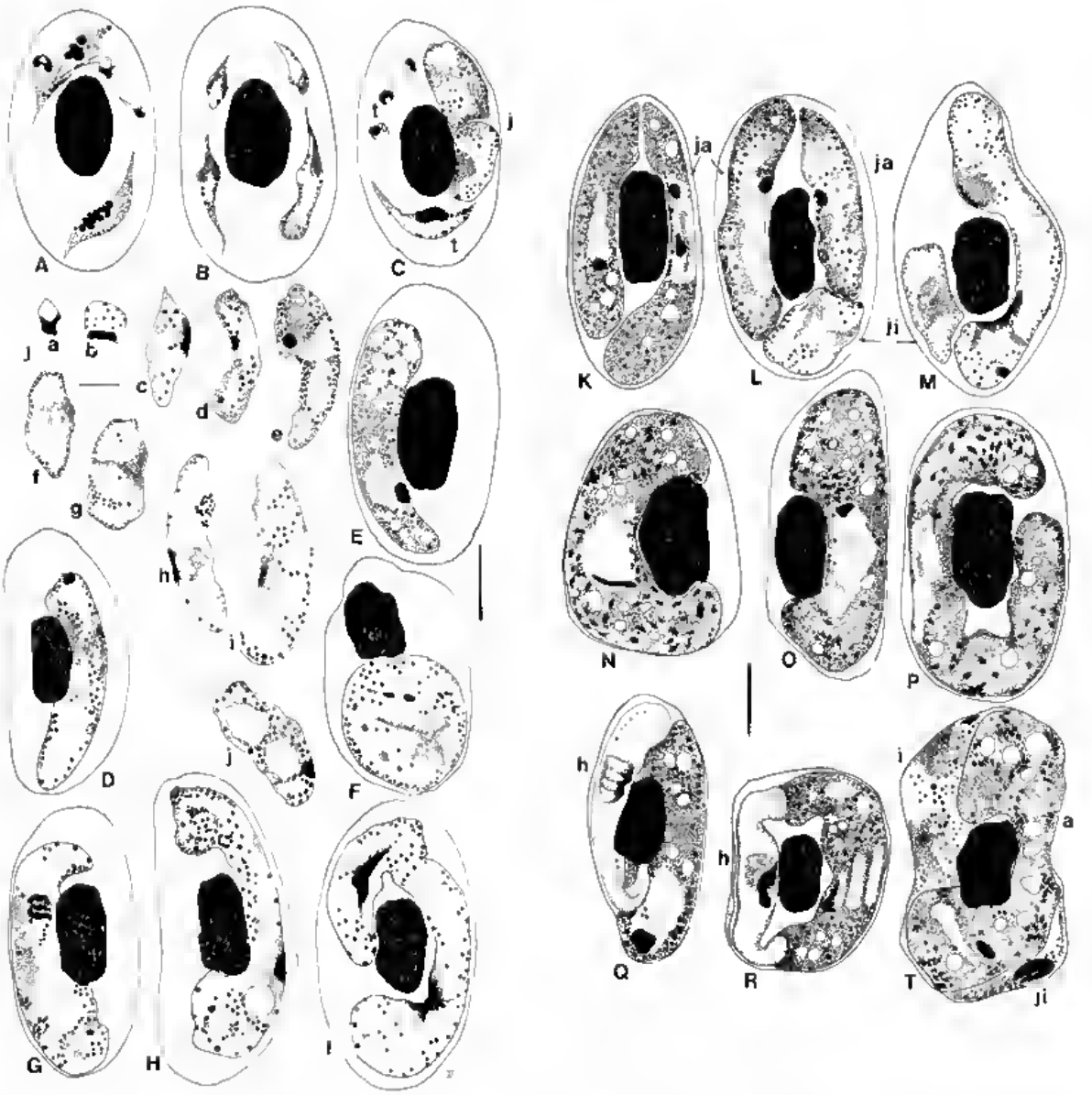


FIG. 8. — *Haemoproteus oedurae* n. sp. . A, B, trophozoites; C, trophozoites and juvenile gametocytes; D, juvenile microgametocyte; E, juvenile macrogametocyte; F-I, microgametocytes; J a-j, developmental stages from trophozoite to gametocyte : a, b, trophozoites; c-e, juvenile macrogametocytes; f-i, juvenile microgametocytes; j, juvenile microgametocyte with two centrally located vacuoles; K, L, multiple infections with juvenile micro and macrogametocytes; M, double infection of juvenile and adult microgametocytes; N-P, macrogametocytes; Q, R, mixed infection of macrogametocyte and an haemogregarine; T, multiple infection of micro and macrogametocytes. Scale A-T = 4 μm; scale a-j = 2 μm.

Source : MNHN, Paris

K, 8K, L, T), or was moved to polar position when the macrogametocyte was either round or exceptionally large and wide (figs. 7G, J). RBC also became disfigured in the few observed double infections with haemogregarines (figs. 8Q, R). Mean size of uninfected RBCs was 16,8 × 9,2 (L/W 1,8 ; n = 8) ; of RBCs infected with a single gametocyte 18-19 × 10 (L/W 1,8 ; n = 31) ; and of RBCs with two or more gametocytes 19-21 × 11-12 (L/W 1,8 ; n = 12).

Prevalence of infection, multiple infections and sex ratio : Infection was discovered in three out of the four *O. castelnaui* collected in Townsville region of Queensland. Infection was persistently low, 0,2-1,4 %, in one (an adult male) for the entire 11 month of follow-up, consisting entirely of mature gametocytes with juvenile stages occuring only rarely. Multiple infections of the RBC were scarce. In the second (subadult male), which survived only three months, parasitaemia was very high (33-68 %) with an abundance of young stages trophozoites and young gametocytes (11-52 %) and with 23-47 % multiple infections in the RBCs. The third (a young male), was negative at capture, but the infection relapsed 2-3 month later (time of onset was overlooked) and persisted for six month (till host death), reaching a peak parasitaemia of 33 % which later gradually declined to 2 %. Trophozoites and young gametocytes were abundant (32-42 %) during the first two month after the relapse of he infection, when the levels of parasitaemia were 14-33 %, and disappeared when infection later declined to 2-14 %. A high abundance of multiple infections coincided with elevated parasitaemia, comprising 11-22 % of the infected RBCs, and subsiding to 0-7 % when parasitaemia was less than 14 %. There were also sporadic occurrences of double infection with macrogametocytes and haemogregarines. Disparity between micro and macrogametocytes was evident during high as well as low-level parasitaemia. The number of macrogametocytes was equal to or slighly outnumbered that of microgametocytes (by ratios of 1,1-1,6 : 1) only for brief periods during both high and low parasitaemia. Otherwise microgametocytes predominated (1,3-15 : 1). Disparity became more extreem with the decline of the parasitaemia.

Transmission trials : Attempts to infect *Culicoides nubeculosus* in the laboratory failed, the other insects refused to feed.

Taxonomic evaluation

H. oedurae is a characteristic halteridium-like haemoproteid. It differs from other halteridian species found in saurian reptiles in the following :

H. oedurae has fine scattered pigment while *H. edomensis, H. phyllodactylli* (Shortt, 1922) and *H. ptyodactyli* have heavy, aggregated pigment. Microgametocytes of the latter species also have numerous vacuoles, rather than the few found in *H. oedurae*. *H. underwoosauri* is differentiated from *H. oedurae* by lack of vacuoles in its macrogametocyte, and in having round rather than halteridiid microgametocytes. Mackerras (1961) reports of an halteridian form of "*H. simondi*" from *Oedura tryoni*. Her data on the haemoproteids are, however, insufficient to make comparisons with other halteridian species of Australian geckoes, namely *H. oedurae* and *H. underwoodsauri*.

Source : MNHN, Paris

Haemoproteus underwoodsauri n. sp.
(Figs. 9, 10)

HOST : *Underwoodsaurus milii* (Bory de Saint-Vincent, 1825).

LOCALITY : Escarpment overlooking the Murrey river in Manum, South Australia.

TYPE SPECIMEN : Slide 150EB deposited in the MNHN.

DESCRIPTION

The very few detected trophozoites were 0,8-2,7 × 0,8-1,6 in size. Juvenile stages were also scarce. Microgametocytes (figs. 9A, B, D, E, 10D, E, H) were round to oval, 5,4-9,6 × 4,0-7,6 (L/W 1,0-1,8, n = 18). Microgametocytes from single infections were slightly smaller and stouter (m = 7,3 × 6,3; L/W 1,18; n = 9) than those from double infections with either micro or microgametocytes (m = 8,4 × 6,4; L/W 1,34; n = 9). The microgametocyte cytoplasm was stained faint red with wide, unstained enclaves (vacuoles). It contained scattered, variable size pigment granules, mostly aggregated at the periphery, and one, sometimes two or three deep red chromatin bodies (caryosome and accessory/polar granules) within or adjacent to a pale red, not well defined nuclear zone.The macrogametocytes (figs. 9C, F, G, 10A-C, F-I), 14,4-19,2 × 3,2-9,6 in size (m = 16,2 × 7,4, n = 13; with L/W of 1,8-6,0, m = 2,5), develops initially as an halteridium alongside the RBCs nucleus (fig. 10A). Fully grown, macrogametocytes occupy most of the RBC volume. In this process the RBCs nucleus remains central, completely enclosed by the parasite's cytoplasm (figs. 10G, H), or is laterally displaced (figs. 9C, F, G). In a very few instances (7 %), the macrogametocyte will expand laterally and displace the host cell nucleus to a polar position, assuming an oval/rounded shape (figs. 10C, F) (L/W 1,1-1,4). One macrogamont was exceptionally long and narrow (fig. 10I), 34,4 × 4,8; released macrogametocytes measured 24 × 8 (fig. 9G). The macrogametocyte cytoplasm stains deep blue and is void of large vacuoles. Pigment granules of variable size are scattered rather than aggregated, but, a few, may be seen concentrated around a small vacuole. A deep red caryosome is always present, adjacent to a pale red nuclear zone.

Effect on the host cells : Mean size of uninfected RBCs was 18,9 × 9,6 (n = 6; L/W 1,98). RBCs infected by single gametocytes were only slightly enlarged : m = 19,4 × 11,5; n = 10 (L/W 2,12), when infected by microgametocytes; m = 19,3 × 9,9; n = 5 (L/W 1,95), when infected by microgametocytes. Mean size of RBCs with double infections was considerably larger, 21,6 × 10,6, n = 4 (L/W 2,0) than that of uninfected RBCs.

Prevalence of infection, multiple infections and sex ratio : Infection was found in one of five *U. milii*. Blood sampled only twice, after capture and 7 days later. Level of parasitaemia was 5,9-6,0 %. Rate of double infections were 15 % and 4 % respectively. Observed micro/macrogametocytes ratios were 1,3 : 1 and 1 : 1 respectively.

Source : MNHN, Paris

Taxonomic evaluation

Macrogametocytes of *H. underwoodsauri* differ from those of other halteridian species found in saurian reptiles (*H. edomensis, H. oedurae, H. phyllodactyli, H. ptyodactyli, H. opluri*) and halteridian forms of *H. tarentolae* by their lack of vacuoles, and their round rather than halteridium-like microgametocytes.

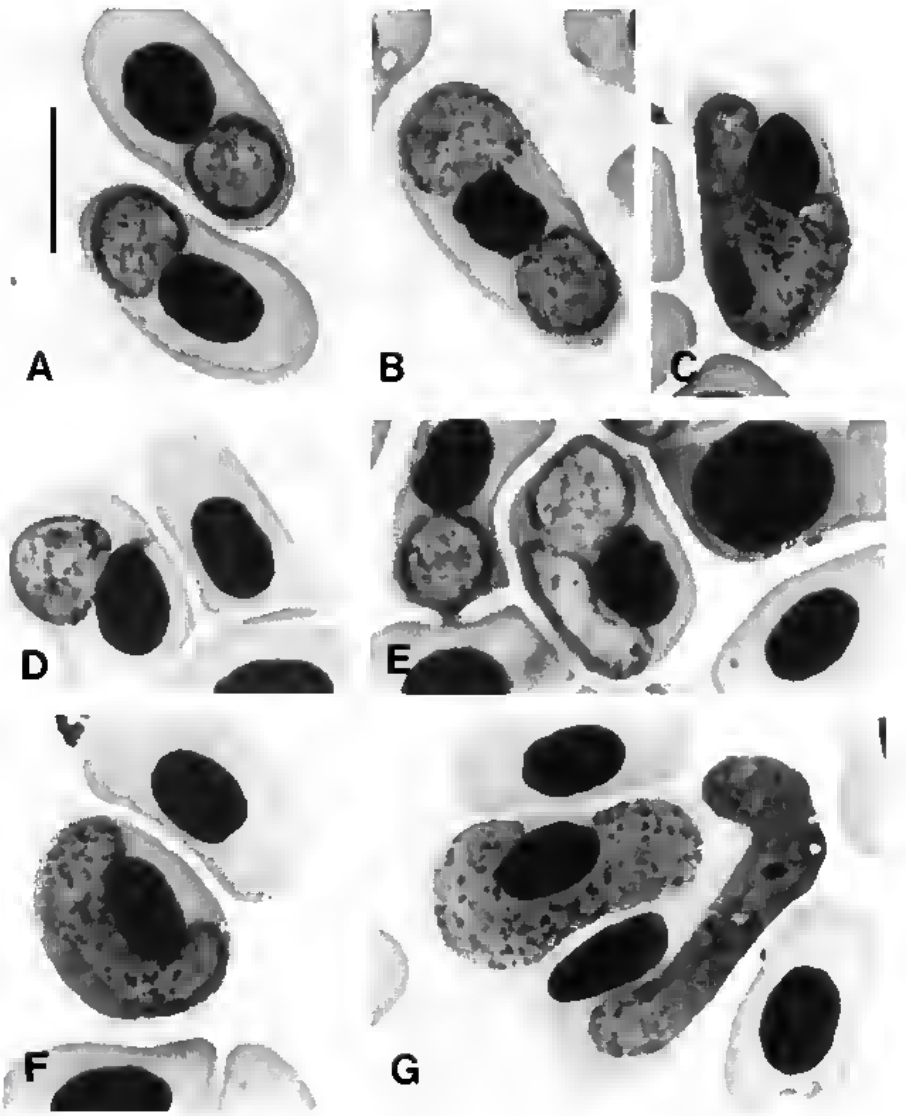


Fig. 9. — *Haemoproteus underwoodsauri* n. sp. : A, B, D, E, microgametocytes; C, F, G, macrogametocytes. Scale = 10 µm.

Source : MNHN, Paris

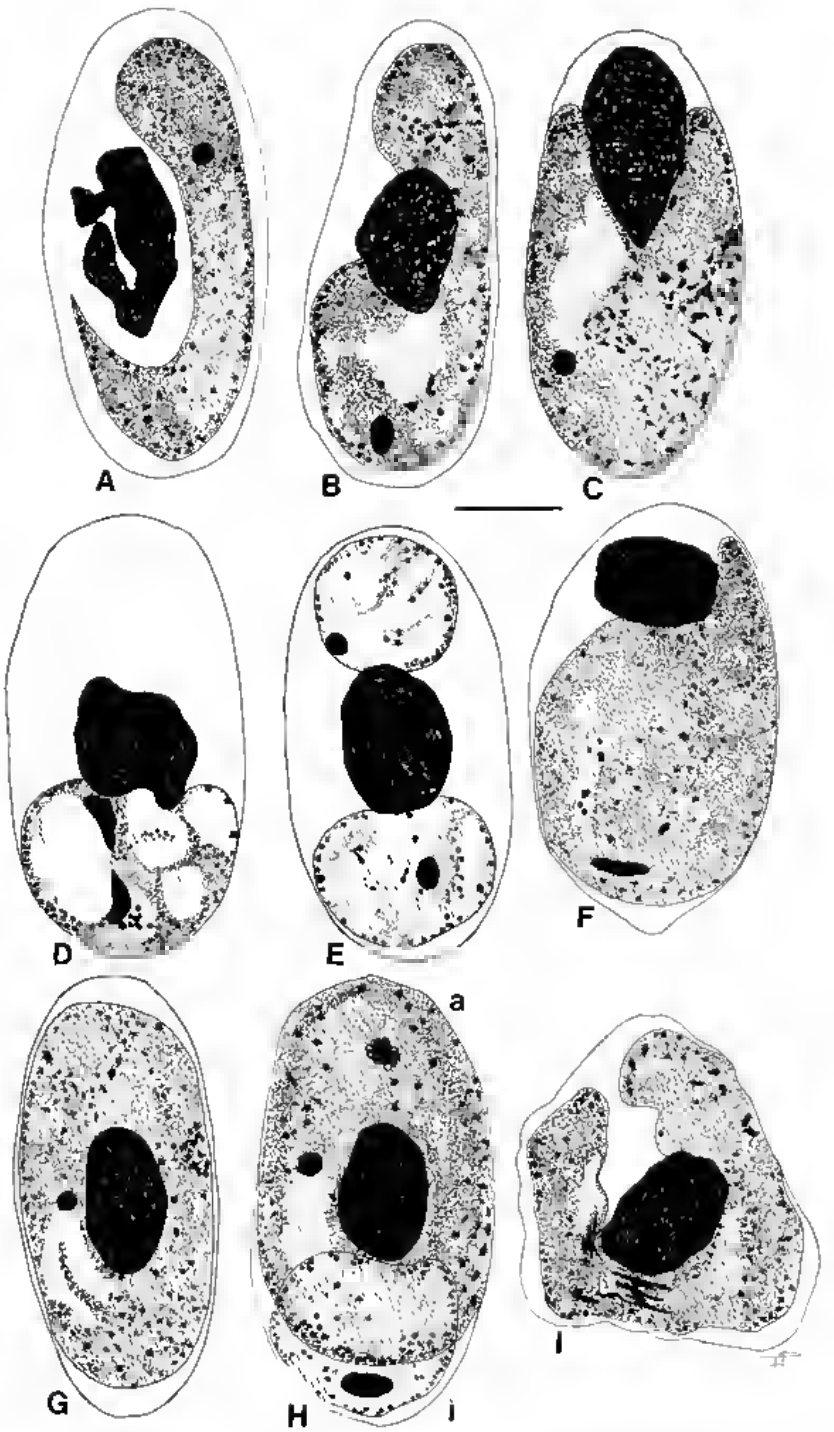


FIG. 10. — *Haemoproteus underwoodsauri* n. sp. : A, young macrogametocyte, B, C, F, G, I, macrogametocytes; D, E, microgametocytes; H, double infection of macro and microgametocytes. Scale = 4 µm.

Source : MNHN, Paris

HAEMOPROTEUS OF MEDITERRANEAN GECKOES

Haemoproteus ptyodactyli n. sp.
(Figs. 11, 12)

HOST : *Ptyodactylus hasselquistii* (Donndorf, 1789).

LOCALITY : Cave at road side near Marg' e Nag'a, Central Jordan Valley, Cisjordan.

TYPE SPECIMEN : On slide 151EB deposited in the MNHN.

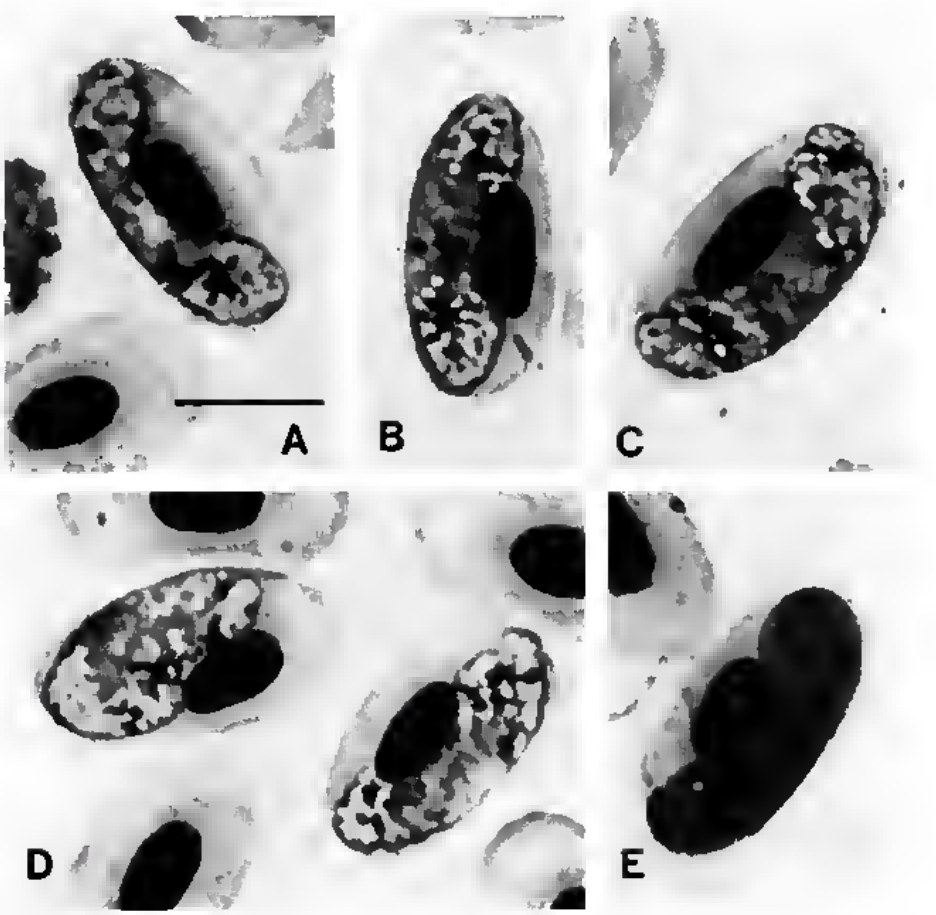


FIG. 11. — *Haemoproteus ptyodactyli* n. sp. : A-D, microgametocytes; E, macrogametocytes Scale = 10 μm.

Source : MNHN, Paris

Description

Microgametocytes were halteridium-like (figs. 11A-D, 12A-C), 16,8-22,4 × 2,4-10,0 (m = 19,6 × 7,4; n = 20), with L/W 2,1-9,0 (m = 4,2). Outlines of the pink nuclear zone were confluent with the pink cytoplasm, a caryosome was at times detectable, and an additional one or two red granules (polar granules) invariably occurred outside the nuclear zone. The cytoplasm contained many vacuoles, particularly at the distal ends of the gametocyte. Coarse, brown to black pigment was either aggregated or scattered at the two distal, heavily vacuolated zones of the cytoplasm.

Macrogametocytes were predominantly halteridia-like (figs. 11E, 12D-I), 15,2-24,0 × 3,6-6,0 (m = 19,9 × 4,8; n = 11), with L/W 3,1-6,6 (m = 3,95); about 15 % were of the rounded type (11,2-13,6 × 8,0-9,2; n = 2) with L/W of 1,4 and 1,47. The red nuclear zone with its large, round caryosome was well-demarcated in the blue-staining cytoplasm. One or two red (polar) granules invariably occurred in the cytoplasm, which also contained a few (1-4) large vacuoles and coarse black pigment which accumulated into one two discrete aggregates at the distal ends.

Effect on the host cells : RBCs infected by microgametocytes and by macrogametocytes did not diverge considerably in shape and size (m = 20,1 × 9,7; n = 18, and m = 19,2 × 9,4; n = 11, respectively) from the uninfected cells (m = 19,2 × 9,8; n = 11).

Prevalence of infection, multiple infections and sex ratio : Infection was discovered in one out of three *P. hasselquistii* captured in May 1989. Parasitaemia (1,6-2,5 %) was comprised entirely of mature gametocytes and there were no multiple infections. Microgametocytes outnumbered macrogametocytes by 1,8-9 : 1. An infection prevalence of up to 60 % is found in geckoes currently under study (since March, 1990) in the same habitat.

Transmission trials : Attempts to infect *Culicoides nubeculosus*, *C. pipiens molestus*, *Phlebotomus papatasi* and *Ph. dubosqi* in the laboratory failed.

Taxonomic evaluation

H. ptyodactyli differs from the other halteridian species : *H. underwoodsauri*, in having exclusively halteridian microgametocytes, from *H. oedurae*, and halteridian forms of *H. tarentolae*, in having their pigment aggregated around the vacuoles, and from *H. edomensis*, *H. opluri* and *H. phyllodactyli* in having numerous vacuoles at the extremities of the microgametocytes. Both micro and macrogametocytes of *H. phyllodactyli* have been reported to have one or two large vacuoles, which are localized at the extremities of the halteridian cell (Shortt, 1922); macrogametocytes of *H. ptyodactyli* contain few, variably distributed vacuoles.

Source : MNHN, Paris

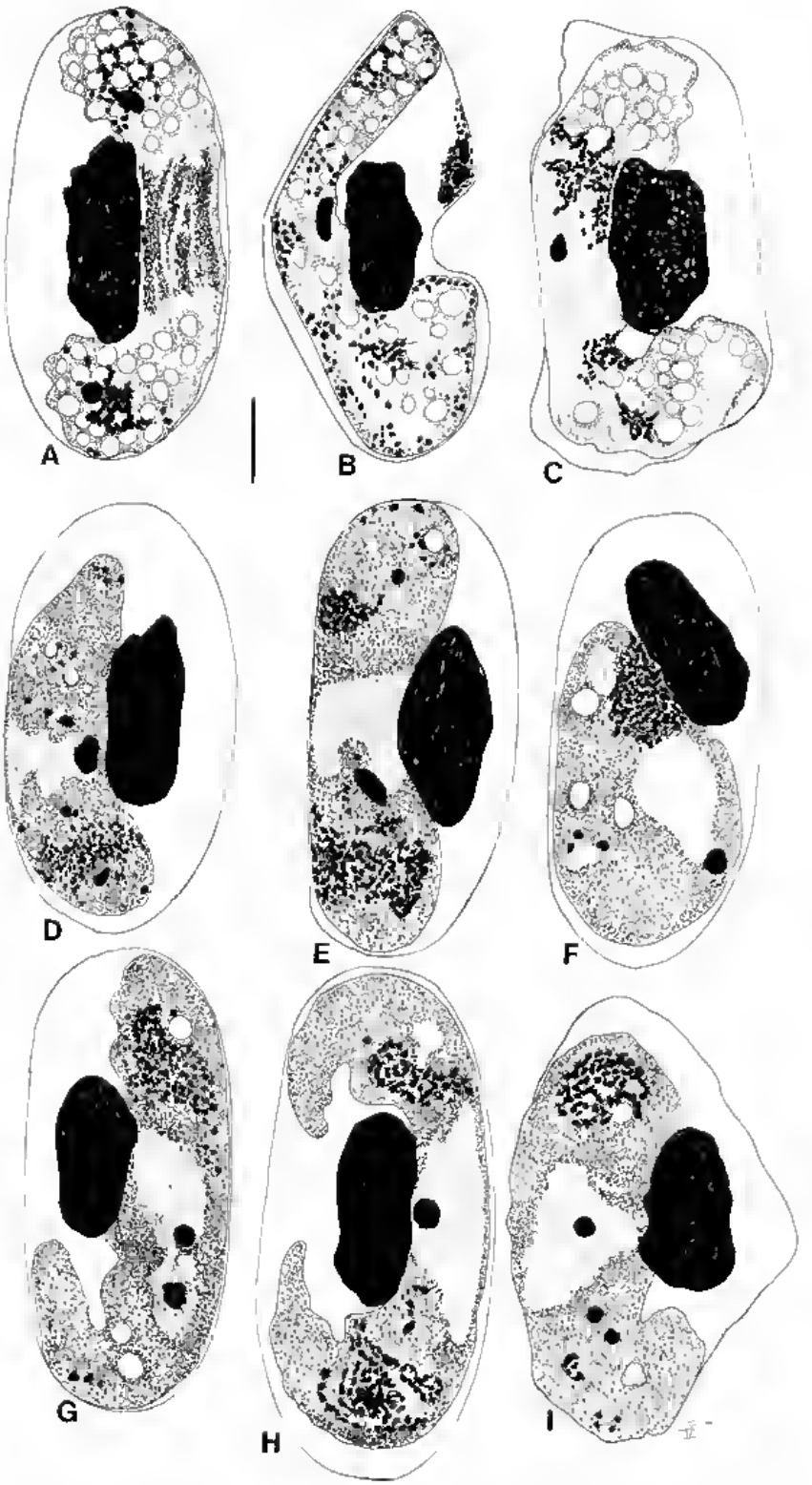


FIG. 12. — *Haemoproteus ptyodactyli* n. sp. : A-C, microgametocytes; D-I, macrogametocytes. Scale = 4 µm.

Source : MNHN, Paris

Haemoproteus tarentolae (Parrot, 1927) Riding, 1930
(Figs. 13, 14)

SYN. : *Haemocystidium tarentolae* Parrot, 1927.

HOST : *Tarentola mauritanica* (L.).

LOCALITY : Rural dwellings and vineyards on the outskirts of Banyuls-sur-Mer, South West France.

SPECIMENS : Slide t47EB deposited in the MNHN.

REDESCRIPTION

Only gametocytes were seen in the peripheral blood. The gametocyte cytoplasm had either a large 1,5-2 in diameter vacuole (figs. 13A, B, D, F, H, I, L, 14A, D, H, I, P), a large compressed cistern (figs. 14E, J), or folds, apparently marking the outlines of an emptied cistern (figs. 14K, P). These were more distinct in the macrogametocyte's intense blue-staining cytoplasm than in the microgametocytes. In other gametocytes we saw neither the vacuole nor its residues (figs. 13E, K, 14L, N, O). Microgametocytes (8,0-17,6 × 4,0-8,0; n = 36) were variable in shape (L/W 1,0-3,4, m = 1,66), being either round, and located in polar position in the RBC (figs. 14D, E) or halteridium-like, and located in a lateral position alongside or behind the RBC's nucleus (figs. 13C, D, K, 14F-H). The nuclear zone was sometimes distinct, but at other times merging with the red-staining cytoplasm. Caryosome and endosomes (polar granules) could only exceptionally be traced. Pigment material comprised coarse grains as well as scattered fine granules.

Round or oval macrogametocytes (figs. 13E-L, 14I-O), were 8,0-16,8 × 6,4-12,0 in size (n = 29) (L/W 1,0-2,2). Size and shape of the macrogametocytes varied with blood films obtained from separate hosts and examination dates and apparently represented different ages and stages of maturity (figs. 14I-L vs. M-O). Vacuoles were common in the apparently younger 8,0-12,8 × 6,4-9,6 (m = 10,6 × 8,35; n = 8) in size group, but were only seen in a few older (> 13 long) macrogametocytes. In blood films taken at later stages (over one month after capture), or from the least infected hosts, macrogametocytes were distinctly larger (11,2-16,8 × 6,4-12,0; m = 14,6 × 8,4; n = 9) (figs. 13I, K, L, 14M, N, O) than those recovered at earlier dates (9,6-15,2 × 6,4-9,6; m = 13,4 × 8,1; n = 12). These large presumably older macrogametocytes were more elongate with a mean L/W of 1,94 (1,7-2,7) than the earlier observed, < 12 µm long macrogametocytes with mean L/W of 1,7 (1,1-2,1).

Effect on the host cells : Infected RBCs were only slightly larger and expanded (m = 18,5 × 12,4; n = 35) than the uninfected cells (17,3 × 9,5; n = 14). Very large macrogametocytes or multiple infection induced further expansion and distortions in the infected RBC (20-21,5 × 8,8-12).

Prevalence of infection, multiple infections and sex ratio : Infection was found in four of the 23 *T. mauritanica*, collected on 8-11.6.89. Levels of parasitaemia in the infected geckoes at capture date were 21 %, 5,5 %, 5,0 % and 1,5 % respectively. In the last gecko, infection was

Source : MNHN, Paris

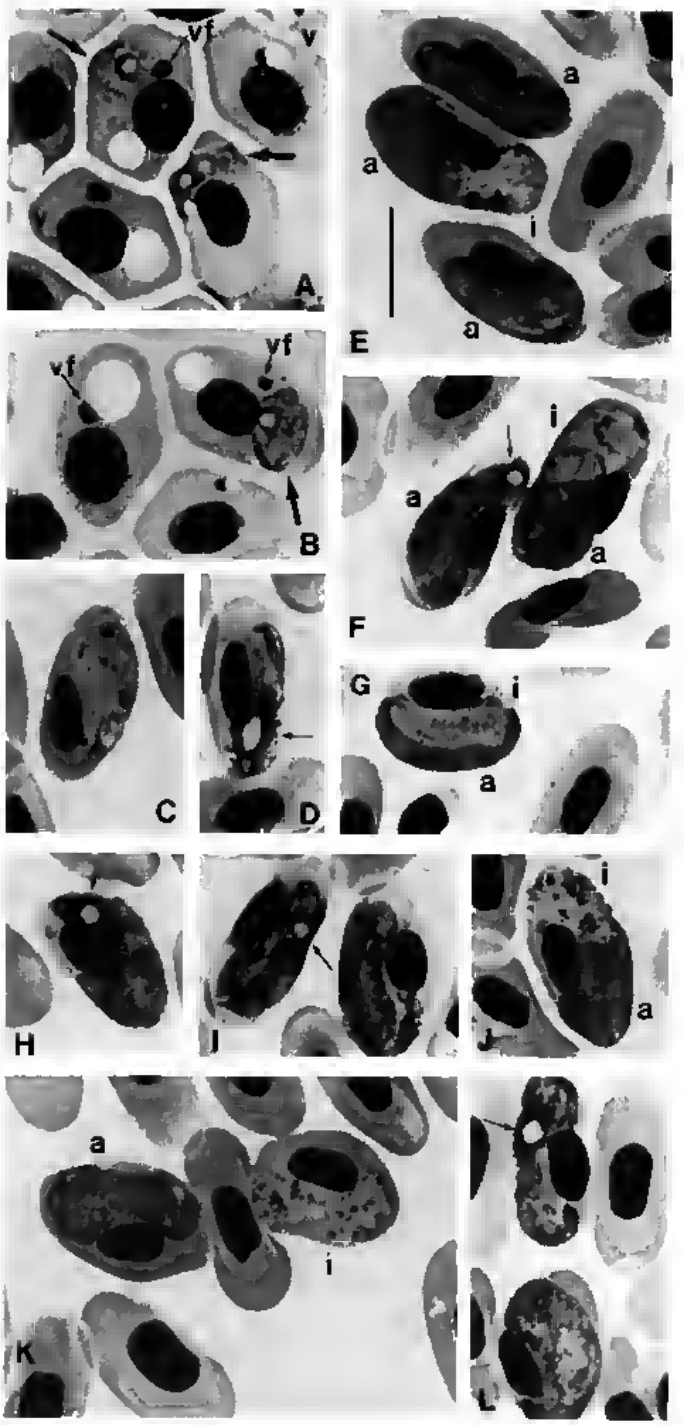


FIG. 13. — *Haemoproteus tarentolae* : The large vacuole is marked by fine arrow. A, B, juvenile macrogametocytes (bold arrows) in a concurrent infection of the RBC with a *Pirhemocyton* virus; C, D, microgametocytes; E-J, L, macrogametocytes in single infections or accompanied with a microgametocyte; K, macrogametocyte and microgametocyte. Scale = 10 μm.

Source : MNHN, Paris

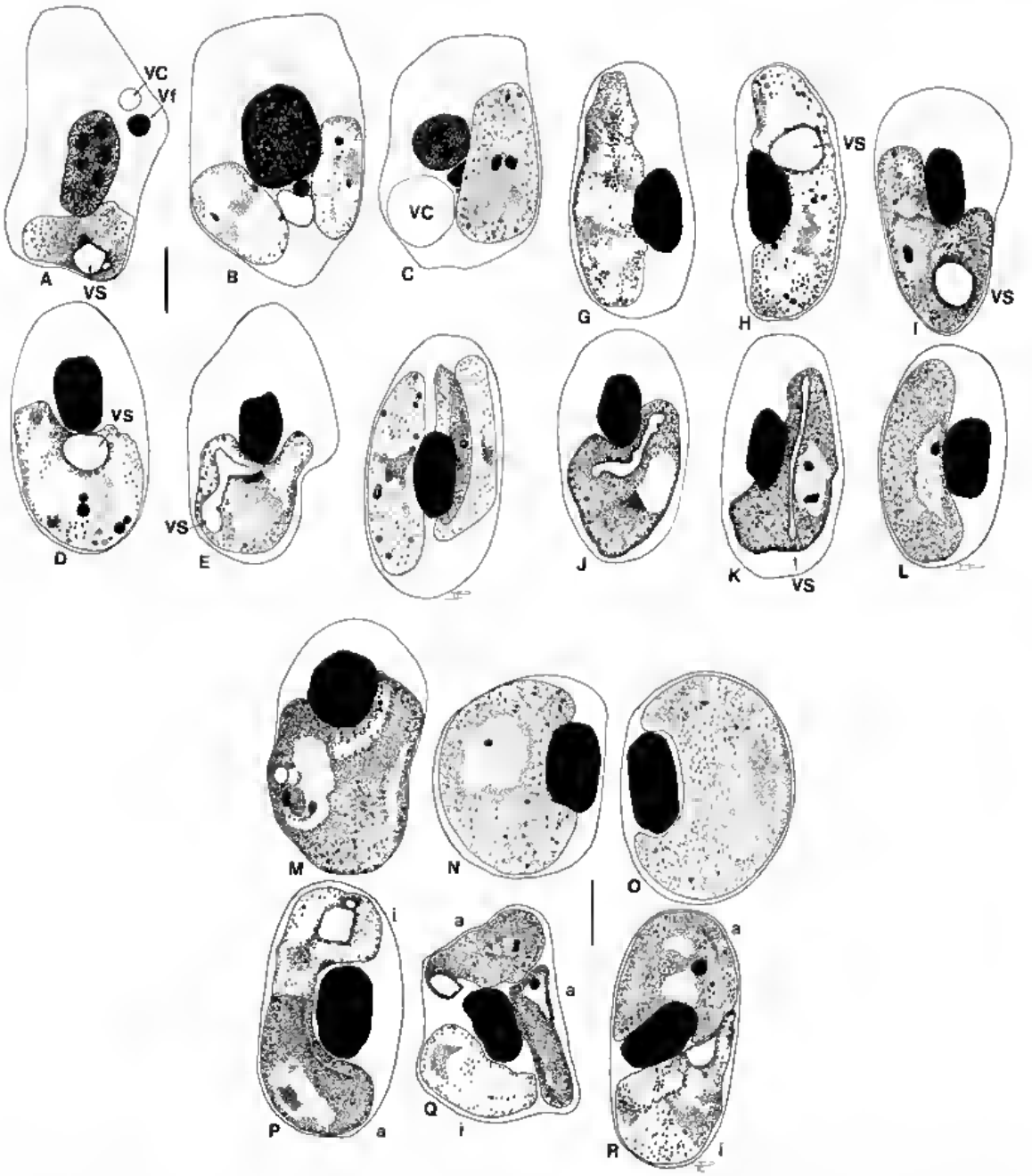


FIG. 14 — *Haemoproteus tarentolae* : A-C, juvenile gametocytes in a concurrent infection with a *Pirhemocyton* virus ; A, C, juvenile macrogametocytes; B, juvenile microgametocytes; D-H, microgametocytes; I-L, early mature magrogametocytes; M-O, old macrogametocytes; P-R, multiple micro and macrogametocyte infections of RBCs. Scale = 4 µm.

Source : MNHN, Paris

concurrent with 69 % parasitaemia with a *Pirhemocyton* virus. In this gecko (as well as in another gecko infected only with the *Pirhemocyton* virus) the infection was accompanied by a drastic proliferation of pro-erythrocytes, which suggested extreme anaemia. The parasites were mostly immature and occurred only in the virally infected cells (figs. 13A, B, 14A, B). The viral infection as well as *H. tarentolae* disappeared from the blood within one month after capture. By then blood cytology had also returned to normal. Levels of parasitaemia in the blood of the remaining three geckoes gradually declined with time. At death or necropsy three month later, the levels of parasitaemia were 4,8 %, 2,8 % and 0,05 % respectively. Multiple infections (figs. 13E, F, J, 14P, Q, R) were most frequent during high parasitaemia (13-18 %). The abundance of multiple infections progressively declined with the aging and decline of infection in the geckoes' blood (from about 5 % to 0-1 %). In the first blood examination after capture there was either parity or slight dominance (1-1,24 : 1) of microgametocytes to macrogametocytes. Thereafter and throughout the period of observation macrogametocytes outnumbered microgametocytes at a rate of 1,4 : 1 to the extreme of 72 : 1.

Transmission trials : Attempts to infect *Culicoides nubeculosus, Culex pipiens molestus* and *Phlebotomus papatasi* in the laboratory failed.

Taxonomic evaluation

Haemoproteus tarentolae described as a new species from *Tarentola annularis* found in Khartum, Sudan by Riding (1930) is in our opinion conspecific with *Haemocystidium tarentolae* described by Parrot (1927) from *Tarentola mauritanica* var. *deserti*, from Algeria. Both descriptions comprise the same parasite at different developmental stages. The vacuole characteristic of Parrot's (1927) parasites is seen in only part of the gametocytes observed in the infected blood of *T. mauritanica* from the South of France. It may not be observable when empty and disappears towards the final stages of gametocyte maturity. The latter stages correspond well with Riding's (1930) parasites. Parrot (1927) noted the occurrence of larged gametocytes in the least infected host, which presumably had been infected for a longer period of time, a phenomenon we observed in our geckoes as well. He also notes the above — mentioned dominance of macrogametocytes in the infected geckoes.

HAEMOPROTEUS OF AGAMID LIZARDS

Haemoproteus edomensis n. sp.
(Figs. 15, 16)

Host : *Agama stellio* Hasselquist and Linn., 1757.

Locality : Maaleh Edomim, 6 km east of Jerusalem, semi-desert, open rocky habitat, Cisjordan.

Type specimen : On slide 146EB deposited in the MNHN.

Source : MNHN, Paris

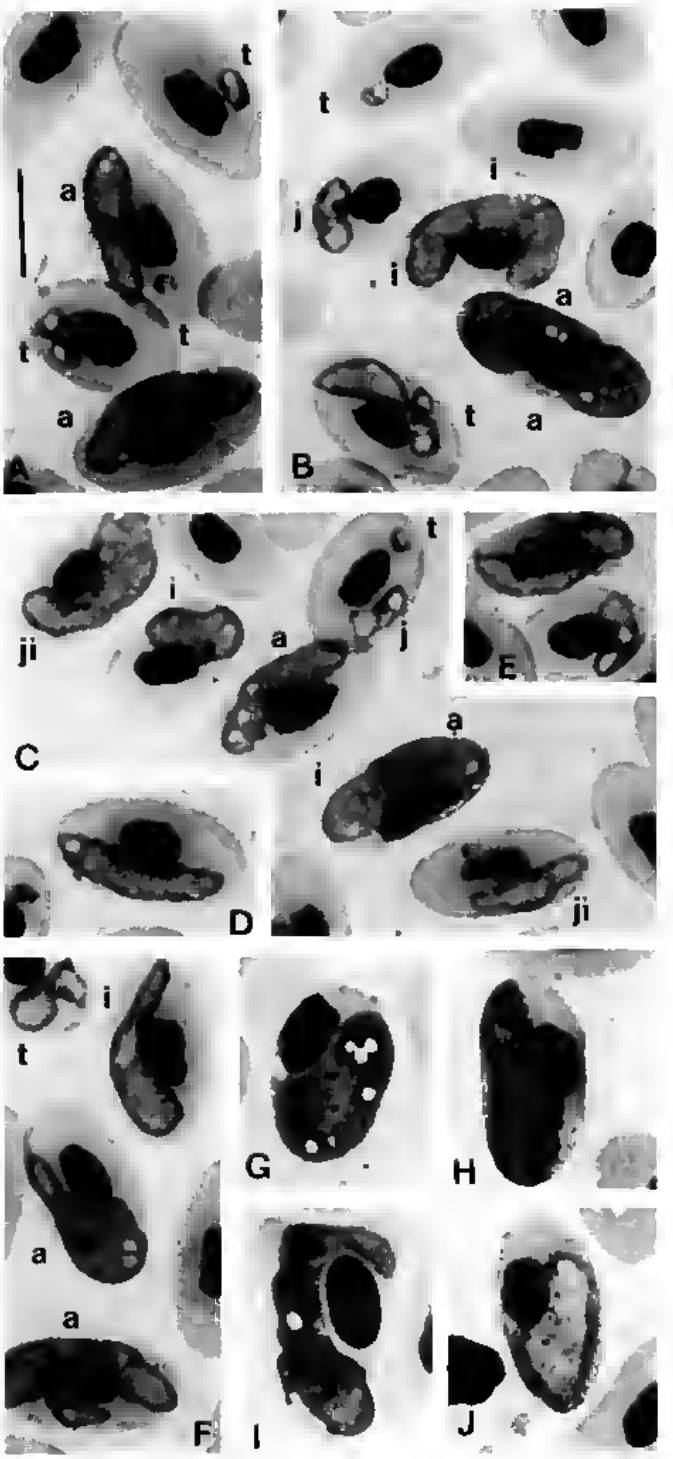


FIG. 15. — *Haemoproteus edomensis* n. sp. : A-F, single and multiple infections with trophozoites, juvenile and premature gametocytes seen during heavy parasitaemia (29-32 %); G-J, gametocytes seen in blood at low parasitaemia (< 4 %); G, H, mature large macrogametocytes; I, multiple macrogametocyte infection; J, mature, large microgametocyte. Scale = 10 µm.

Source : MNHN, Paris

Description

Observed trophozoites were round, 1,6 × 1,6 to 2,4 × 1,2-1,6 in size, usually with an unstained center and a peripheral zone of blue-staining cytoplasm, a red-staining nuclear zone and a few pigment granules (figs. 15A, B, C, 16A). On-growing trophozoites, 4,0-5,4 × 1,6-3,2 in size, gradually assumed an elongated halteridium shape (L/W 1,7-2,3) (figs. 16B, a-c) while some maintained a rounded form (L/W 1,0-1,6) (figs. 15B, C).

Mature microgametocytes were not readily distinguishable from the immature ones. Within the observed size range of 4,8-17,6 × 2,4-11,2 (figs. 15B, C, E, F) the larger, 9,6-17,6 × 3,2-11,2 (m = 13,0 × 6,2; n = 26), presumably mature microgametocytes (figs. 15J, 16K-M) contained appreciable amounts of scattered pigment and one to several deep-red

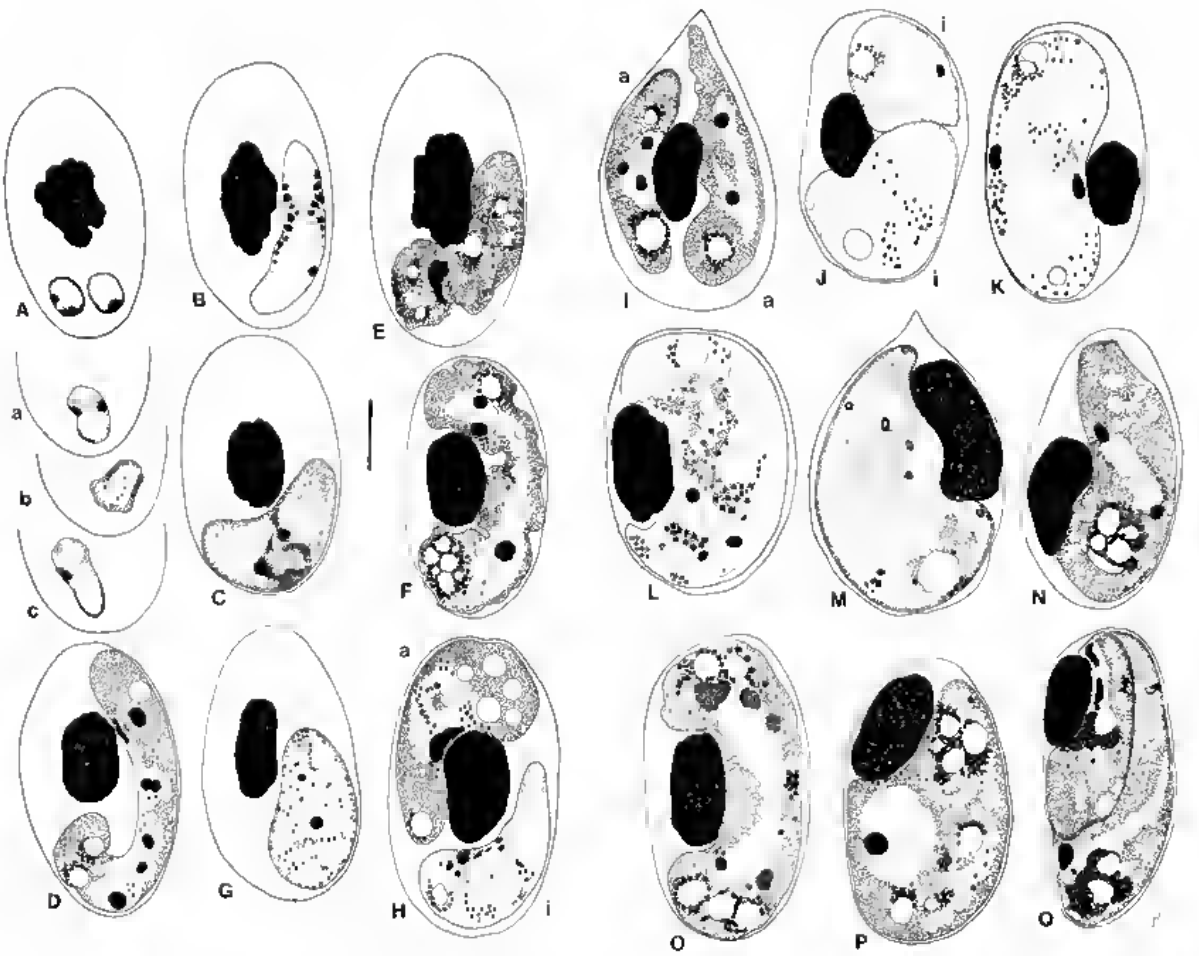


Fig. 16. — *Haemoproteus edomensis* n. sp. : A, a-c, trophozoites; B, juvenile (micro-?) gametocyte; C, D, juvenile macrogametocytes; E, F, mature macrogametocytes; G, premature microgametocyte; H-J, double infections with gametocytes; K-M, mature, large microgametocytes; N-P, mature, large macrogametocytes; Q, double infection with mature macrogametocytes. Scale = 4 μm.

Source : MNHN, Paris

staining discrete bodies or scattered aggregates of chromatin (caryosomes) in their light pink cytoplasm (figs. 16K, L). A few large microgametocytes stained uniformly deep red (figs. 15J, 16K, M). Some had one or several small vacuoles. Fifty eight percent of adult microgametocytes were elongated halteridia (L/W > 2,0 (2,0-5,2)), located laterally in the RBC, alongside the nucleus (figs. 15B, F, 16K-M), while 42 % were rounded (spherical) (L/W < 2,0 (1,1-1,9)), located at a polar end of the RBC (fig. 15C). Total L/W for all seemingly mature microgametocytes was 2,18, compared with L/W = 1,72 for juveniles, 6,4-12,0 × 2,4-8,8 (m = 10,3 × 4,8; n = 16) in size. Among the latter, 50 % were elongated and 50 % rounded (figs. 15B,C,F, 16G,H, J).

Mature macrogametocytes (12,0-20,8 × 3,2-8,8; m = 15,0 × 6,0; n = 38) occurred predominantly as halteridia (85 %), alongside the RBC's nucleus, with a L/W of 2,0-4,4 (m = 2,9; n = 32) (figs. 15F, I); some had undulating margins (figs. 15H, 16E, F). The remaining 15 % were rounded, with L/W 1,0-2,0 (m = 1,63, n = 6) and located in a polar position (figs. 15B, C, 16P, Q). Macrogametocytes' blue-staining cytoplasm contained a well-defined red-staining nuclear zone, with one or two adjunct deep red-stained caryosomes. Additional scattered or aggregated deep red stained chromatin also occurred within the nuclear zone. In the cytoplasm the dark pigment accumulated mainly around one of several large (0,4-1,0 diameter) vacuoles situated usually on one or both ends of the macrogametocyte (figs. 16N-Q). In the largest macrogametocytes (long axis > 17) (figs. 15G, H, 16P, Q) the pigment precipitated into heavy, coarse, brown particles, in the smaller ones (< 17 long axis) the pigment material was finer and more dispersed (figs. 15B, C, F, 16H, N).

Young macrogametocytes 7,2-12,0 × 2,4-8,8 (m = 9,4 × 5,0; n = 17) had fewer or altogether lacked large vacuoles, and their pigment was either scattered or beginning to aggregate. Over half (58 %) were halteridians, located alongside the nucleus, the rest were round, in a polar position (overall L/W 1,0-3,3; m = 2,1; n = 17) (figs. 15C, D, F, 16C-E, H, I).

Effect on the host cells : Infected RBCs were larger than uninfected ones. Mean size of RBCs infected with mature microgamonts was 17,0 × 10,3 (L/W 1,65; n = 26), with mature macrogamonts 17,5 × 9,4 (L/W1,61; n = 38) and with double, multiple infections 19,0 × 11,0 (L/W 1,68; n = 10). Uninfected RBCs were 16,2 × 9,2 (L/W 1,88; n = 10). Displacement of the nucleus occurred in only a few of the infected RBCs, most notably in double-infected cells.

Prevalence of infection, multiple infections and sex ratio : Infection was recovered in one out of 3 *Agama stellio* collected in March 1986 and in one out of five lizards collected in November 1988. In the first lizard, level of parasitaemia remained high (30-32 %) from the time of capture till death, 60 days later. Infection was predominantly by young stages — trophozoites (18-30 %) and young gametocytes (38-56 %), with 19-25 % of the infected RBCs having multiple infection. In the second lizard, the level of parasitaemia was initially very low (0,6 %) but it gradually increased and three months later, reached 3 %. It then remained in the range of 1-4 % untill the lizard's necropsy eight month after capture. Throughout this period trophozoites and early gametocytes were consistently present and comprised 20-75 % of the parasites seen in the RBCs. Most observed multiple infections (comprising 2,5-16 % of the infected RBCs) consisted predominantly of trophozoites and immature gametocytes. In spite of finding trophozoites in blood examined at the time of necropsy, exoerythrocytic stages were not found in all examined visceral organs (liver, spleen, kidneys, lungs, brain). Macrogameto-

Source : MNHN, Paris

cytes consistently outnumbered microgametocytes in both infected lizards throughout the observation period at rates ranging from 1,3 to 38 : 1.

Transmission trials : Attempts to infect in the laboratory *Culicoides nubeculosus*, *Phlebotomus papatasi* and *Culex pipiens molestus* failed.

Taxonomic evaluation

Heavy aggregated pigment around the large vacuoles as seen in *H. edomensis* macrogametocytes has been only observed in the other reptilian species *H. kopki* de Mello, 1916 and *H. phyllodactyli* Shortt, 1922; in the former this characteristic has only been observed in the microgametocyte, while in the latter in both sex gametocytes. In *H. edomensis* the pigment aggregates only in the macrogametocyte. *H. phyllodactyli* has been described as invariably having two vacuoles at polar positions, surrounded by the aggregated pigment (Shortt, 1922). In *H. edomensis* the number of vacuoles and their location in the cytoplasm is variable. *H. grahami* Shortt, 1922, the only other described species from agamid lizards has scattered pigment in both type gametocytes. *H. grahami* has been recorded in *A. nupta* from west-north Iran (Shortt, 1922), in *A. nupta* from west Pakistan (Telford, 1984) and in *A. caucasica*, *A. lehmanni* and *A. erythrogaster* from Turkmenistan and Uzbekistan SSR (Bogdanov, Markov & Radchenko, 1970; Ovezmukhamedov, 1987).

There are several brief reports of *Haemoproteus* sp. infections in African *Agama* lizards : in *A. agama* from Nigeria (Macfie, 1914), in *A. agama* in Liberia (Bray, 1959) and in *A. cyanogaster* from Uganda (Ball, 1967). None of these *Haemoproteus* have the characteristic aggregated pigment seen in *H. edomensis* macrogametocytes. *H. agamae* Wenyon, 1909 described from *A. colonorum* (syn. of *A. agama*) found in Bakher-el-Ghazal was later (Wenyon, 1915) reidentified as a species of *Plasmodium*.

HAEMOPROTEUS FROM LIZARDS FROM MADAGASCAR

Haemoproteus opluri n. sp.
(Figs. 17, 18)

Host : *Oplurus cuvieri* (Gray, 1831).

Locality : Majunga (type locality, slides 234LL, 236LL) and Belo sur Tsiribihina (slides 37LL), Madagascar.

Type specimen : On slide 234LL, deposited in the MNHN.

Description

Blood smears only contained fully-differentiated micro and macrogametocytes. Parasites obtained from lizards in Majunga (234LL, 236LL) were larger than those found in the lizard from Belo sur Tsiribihina (37LL). The latter also differed in some cytological details.

Source : MNHN, Paris

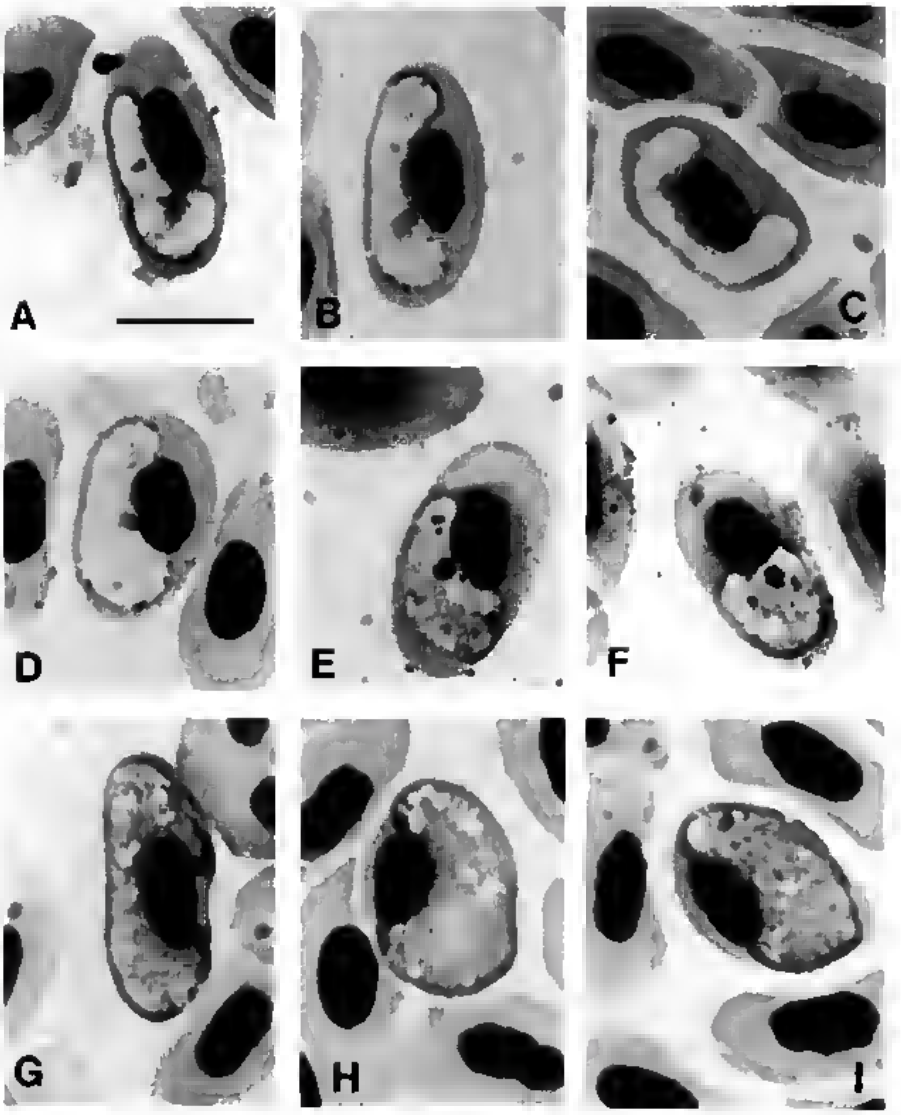


FIG. 17. — *Haemoproteus opluri* n. sp. : from hosts 234LL & 236LL ; A-E, microgametocyles ; F-I, macrogametocyles. Scale = 10 μm.

Data from 234LL and 236LL : Microgametocytes (figs. 17A-E, 18A, B) were usually oblong, 12,8-18,4 × 3,2-11,2 in size (m = 14,2 × 6,4 ; L/W 1,3-5,75, m = 2,7 ; n = 12), but a few were oval (10,4-13,6 × 9,6-11,2 ; L/W 1,1-1,2) (fig. 17F). The microgametocyte cytoplasm stained faintly blue-red, with faint outlines of vacuoles, and contained a deep red-staining whole or fragmented caryosome within a faint red nuclear zone, and in some cases accessory red granules. Fine pigment granules occurred mainly on the periphery. Macrogametocytes were halteridia-like (figs. 17G-I, 18C-F), 13,6-19,2 × 4,8-12,0 (m = 16,6 × 8,5 ; L/W 1,3-3,5, m = 1,97 ; n = 15). The blue-staining cytoplasm was of a foamy texture and contained a

Source : MNHN, Paris

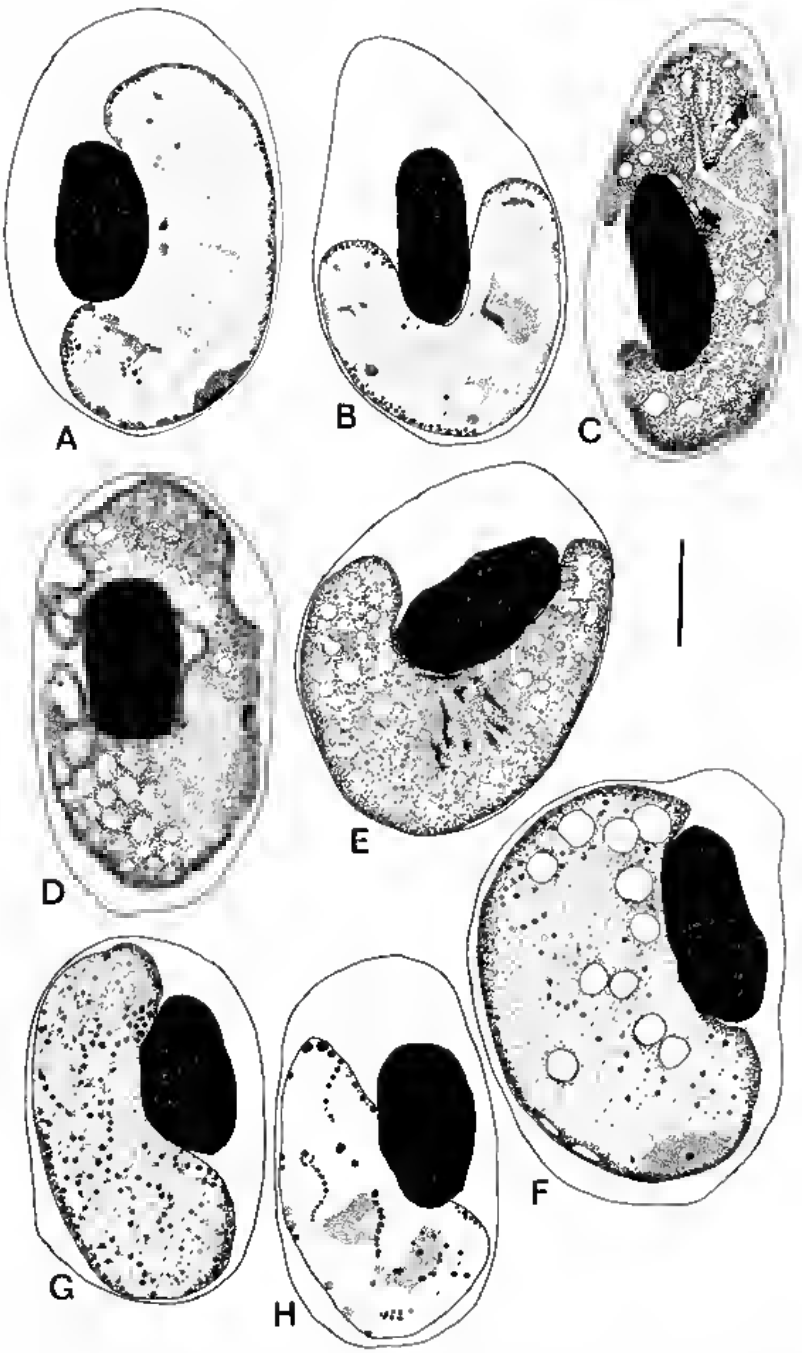


FIG. 18. — *Haemoproteus opluri* n. sp. : A-F from hosts 234LL, 236LL : A, B, microgametocytes; C-F, macrogametocytes; G, H, n from host 37LL : G, macrogametocyte; H, microgametocyte. Scale = 4 μm.

Source : MNHN, Paris

variable size, faintly outlined nuclear zone with a small or fragmented caryosome and a variable number of vacuoles. Fine pigment granules were scattered at random.

Data from 37LL : Microgametocytes 9,6-14,4 × 4,0-7,2, in size (m = 11,4 × 5,9; L/W 1,3-3,0, m = 2,0; n = 5) contained a larger concentration of coarse pigment granules (fig. 18H). Macrogametocytes were oblong and halteridia-like, 12,0-17,6 × 4,0-7,2 in size (m = 13,3 × 7,1; L/W 1,5-4,4, m = 2,2; n = 8), located alongside the RBC's nucleus, or oval, 10,4 × 9,6; 12,0 × 8,0; L/W 1,1; 1,5, in a polar position. The macrogametocyte's blue cytoplasm contained heavy concentration of pigment granules, while the nuclear element remained unstained (staining artefact?). Vacuoles were absent.

Effect on the host cells : In 234 and 236LL RBCs infected with microgametocytes usually retained their normal dimensions [16,8-21,6 × 8,8-12,0 (m = 18,6 × 10,6; n = 12) vs. normal RBC sizes of 15,2-20,8 × 8,0-10,4 (m = 19,3 × 9,4; n = 10)]. Oblong microgametocytes surrounded the centrally positioned RBC's nucleus, causing lateral expanding of the RBC in some. Oval microgametocytes were located at the polar end of the RBC, displacing its nucleus. RBC infected with macrogametocytes, similarly, retained their usual dimensions [16,0-20,8 × 8,8-12,8 (m = 18,2 × 10,6; n = 15)]. The oblong macrogametocytes were positioned alongside the nucleus. Very large specimens displaced the RBC's nucleus to marginal position, causing lateral expansion of the RBC (14,5 × 10-11). Some macrogametocytes completely enclosed the nucleus while displacing the entire cytoplasm. In 37LL, RBCs infected with microgametocytes and macrogametocytes were of somewhat reduced dimensions 14,4-19,2 × 8,8-12,8 (m = 16,1 × 10,4; n = 5); and 13,6-17,6 × 8,8-12,0 (m = 16,1 × 10,6; n = 8) in size respectively.

Levels of parasitaemia, multiple infections and sex ratio : In the three infected *O. cuvieri* 234LL, 236LL and 37LL, levels of parasitaemia were 0,2-0,4 %. Multiple infections were very rare. In Majunga lizards, there was a pronounced (1,8-2,75 : 1, in 234LL) or slight (1,1 : 1, in 236LL) dominance of microgametocytes. In the lizard from Belo sur Tsiribihina (37LL) microgametocytes were dominant (5,5 : 1).

Taxonomic evaluation

The nearly total absence of red stain in the microgametocyte cytoplasm, together with the very distinct appearance of the red-staining nuclear zone and the dense caryosome are unique features for this species. Fully developed macrogametocytes become very wide, contain several to many, very distinct large vacuoles, and fine granulated rather than coarse pigment. Among known species of reptilian *Haemoproteus* the only other species which possesses such combination of features is *H. oedurae*. The latter retains more pronounced halteridian characteristics, and shows a dense cytoplasm rather than the foamy one seen in this species. The distinct taxonomic status of the host (Opluridae) and its geographic location (Madagascar) further advocates the classification of this described *Haemoproteus* as a new species.

Differences between parasites seen in *O. cuvieri* from Majunga (234, 236LL) and from Belo sur Tsiribihina (37LL), mainly in size (but also in sex ratio) are likely to reflect differences between early and progressive stages of the infection. The invisibility of the nuclear zone in 37LL slides is apparently due to a fault or a degradation of the stain.

Source : MNHN, Paris

Haemoproteus cf. opluri
(Figs. 19, 20)

HOST : *Oplurus quadrimaculatus* A. Duméril, 1851.

LOCALITY : Fort Dauphin/Baie de Loukaro, Madagascar.

SPECIMENS : Slides deposited in the MNHN.

DESCRIPTION

Available blood smears only contained micro and macrogametocytes.

Microgametocytes were round or oval, 6,4-9,6 × 3,6-7,2 in size, L/W 1,0-2,6 (m = 8,2 × 5,9; L/W 1,6; n = 6), located at one end of the RBC (figs. 19A, 20D, E). The usually stain-resistant cytoplasm contained fine and coarse pigment granules, a scattered nuclear zone and, occasionally a caryosome. Young macrogametocytes (fig. 20A) were 4,0-4,8 × 2,4-4,0 in size, round, and their cytoplasmic components were identical to the larger macrogametocytes. The latter (figs. 19B-F, 20B, C, E) were round or oval, with occasionally undulating margins (fig. 20B), 8,0-12,0 × 6,4-8,8 in size, L/W 1,0-2,3 (m = 10,8 × 7,4; L/W 1,34; n = 21). One

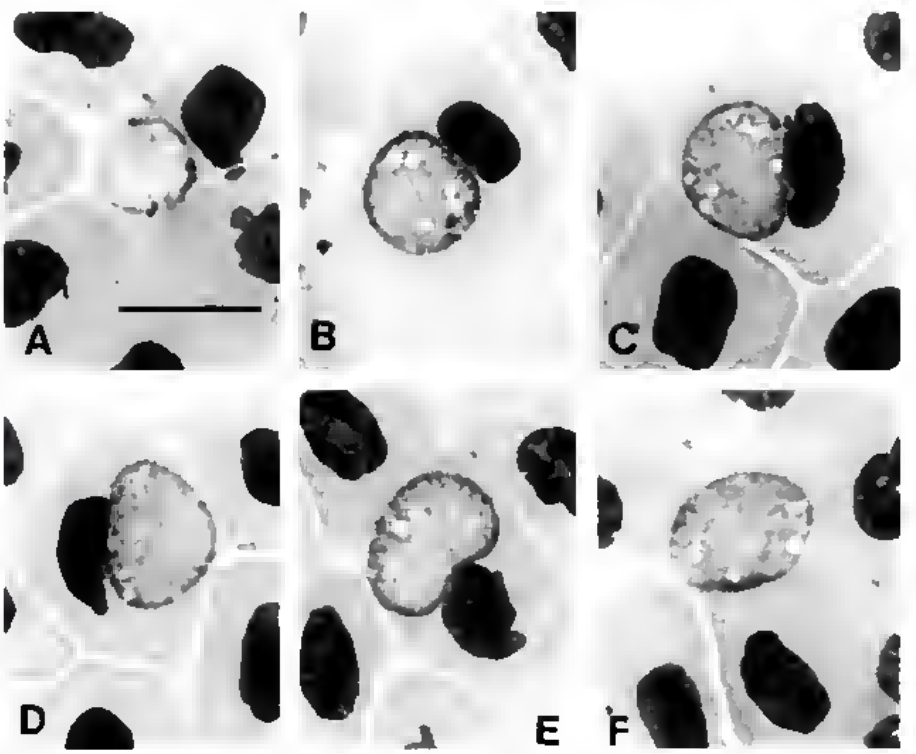


FIG. 19. — *Haemoproteus* cf. *opluri* : A, microgametocyte; B-F, macrogametocytes. Scale = 10 µm.

Source : MNHN, Paris

specimen (fig. 20B) was elongate (13,6 × 4,8; L/W 2,8). The foamy cytoplasm contained few vacuoles, scattered fine pigment granules and an extensive nuclear zone; caryosomes were not detectable. The macrogametocytes were either located alongside the nucleus (figs. 19C, D), or at one end of the RBC (figs. 19A, B, F).

Effect on the host cells : Uninfected RBCs were 16,8-20,0 × 8,8-12,8 in size (m = 18,9 × 10,8; n = 10). Infected RBCs remained about the same, when infected with microgametocytes : 17,0-21,6 × 8,8-12,0 (m = 19,2 × 9,7; n = 6), or macrogametocytes : 17,6-20,8 × 8,0-12,0 (m = 18,7 × 10,4; n = 13). Occasionally cells infected with gametocytes expanded laterally to a width of 12,8-14,4 (L/W 1,1-1,3).

Prevalence of infection, multiple infections and sex ratio : Level of parasitaemia varied within the range of 0,5 % to 1,3 %. Multiple infections seen once, with two juvenile macrogametocytes (fig. 20A). Macrogametocytes outnumbered microgametocytes by 2,6-11,0 : 1.

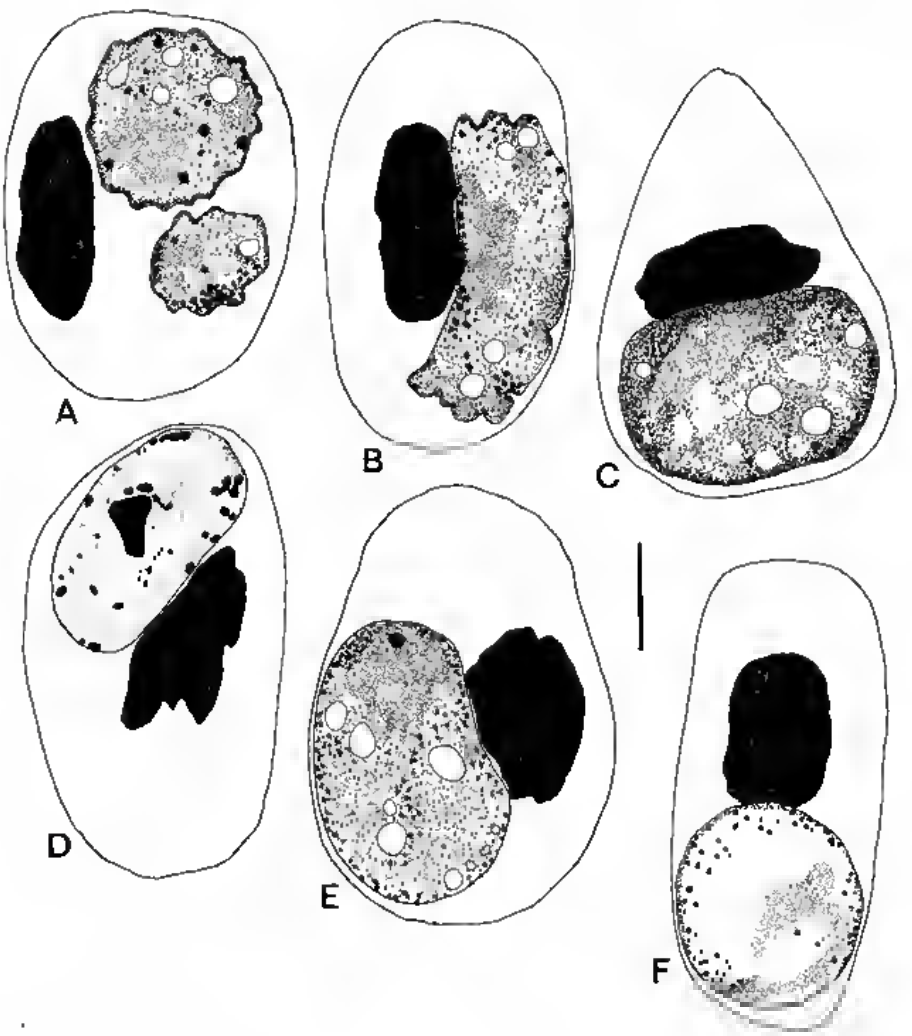


FIG. 20. — *Haemoproteus* cf. *opluri* : A, double infection by young macrogametocytes; B, C, E, macrogametocytes; D, F, microgametocyles. Scale = 4 µm.

Source : MNHN, Paris

Taxonomic evaluation

Both micro macrogametocytes closely resemble *H. opluri* in their cytoplasmic details. They differ mainly in size and in having a generally rounded shape. Also macrogametocytes numerically predominate microgametocytes while in *H. opluri* in two out of three of the hosts examined, microgametocytes outnumbered macrogametocytes.

Haemoproteus from *O. cuvieri* and *H. quadrimaculatus* seem to be conspecific. The differences listed above could be the result of specimens being at an earlier stage of infection, or of a different level of compatibility with the host, causing the formation of smaller mature gametocytes.

DISCUSSION

Criteria for specific differenciation

Gametocytes' size and position in the RBC host cell is used for differentiating species of avian *Haemoproteus* (Bennet & Campbell, 1972). In some species of saurian hemoproteids, shape (oval or halteridian) and position within the RBC are a variable, while in others it is an invariable characteristic. Other characteristics employed for species differenciation are the pattern of the pigment distribution, number and dispersal of vacuoles and vesicles and stainability of nuclear organelles. All these characteristics may differ in micro and macrogametocytes (examples ; *H. kopki*, de Mello, 1916, Telford, 1982; *H. underwoodsauri*, *H. edomensis*, present study) and may change with the gametocyte age (maturation or senility, example : *H. tarentolae*, present study). Differential diagnosis preferably should analyze data from a population, comprised of premature and mature of both micro and macrogametocytes. Staining as well as pigment composition was found sometimes to deteriorate in stored museum slides.

Course of infection and sex ratios seem to be equally important differential characteristics as structural affinities. Among the *Haemoproteus* species studied here, there was a clear, interspecific variability in the production rate of young gametocytes (i.e. recrudescence of blood gametocytes) as well as in the prevalence of multiple infections in the RBC. In some species recruitment of juveniles was limited to the early period of the infection only (*H. underwoodsauri*, *H. ptyodactyli*, *H. opluri* and apparently also *H. simondi*) or occurred intermittently throughout the period of parasitaemia (*H. gehyrae*, *H. tarentolae*). In others, it was continuous, persisting throughout the period of the parasitaemia (*H. edomensis*), or at least throughout the period of high parasitaemia (*H. oedurae* and apparently also *H. mackerrasi*).

Multiple infections appear to be parasite density-dependent and therefore also coincided with active juvenile recruitment (in *H. oedurae*, *H. edomensis*). However, their rarity or complete absence in some species (*H. ptyodactyli*, *H. opluri*) and their permanent abundance in

Source : MNHN, Paris

others (*H. simondi, H. mackerrasi, H. gehyrae*) might be regarded as a species characteristic. Interspecific variations with respect to presence or rarity/absence of multiple infections were evident in the genus *Fallisia* (Lainson, Shaw & Landau, 1974; Telford, 1986; Paperna & Landau, 1990).

There is a characteristic disparity between micro and macrogametocytes which is maintained throughout the greater part of the course of infection in the blood. In most species microgametocytes were predominant throughout the observation period or most of it. The exceptions were *H. simondi, H. tarentolae* and *H. edomensis*, where macrogametocytes were dominant. Sex ratios were variable only in *H. opluri*, but our follow-up period was very short. Data on sex ratios among gametocytes of other haemospidia other than from reptiles are scarce; in the saurian plasmodiids : *Plasmodium mexicanum, P. agamae* and *P. giganteum*, and in *Fallisia effusa* and *F. copemani* macrogametocytes were dominant (Lainson, Shaw & Landau, 1975; Schall, 1989; Paperna & Landau, 1990).

Generic status

Haemoproteid parasites of mammals were given separate generic status from those from avian and reptilian hosts (Garnham, 1966). Haemoproteids of avian hosts are divided between two genera : *Haemoproteus* and *Parahaemoproteus*, differentiated from each other by their specific vectors and the nature of their exoerythrocytic stages (Garnham, 1966).

Data on developmental stages of reptilian haemoproteids, other than the intraerythrocytic, are available only on *H. metchhnikovi* — exoerythrocytic stages (Sterling & de Giusti, 1972) and developmental stages in the vector (de Giusti, Sterling & Dobrzechowski, 1973), and on the exoerythrocytic stages of *H. simondi* (Shortt, 1962). These data are insufficient to offer enlightenment as to the taxonomic affiliations of reptilian haemoproteids with the genus *Haemoproteus* (s. str.), or to support any generic definition of reptilian haemoproteids.

Haemoproteids of lacertilian reptiles were segregated into a separate genus *Haemocystidium* Castellani & Willey, 1904. Into this genus Johnston & Cleland (1909) also included haemoproteids described from a chelonian host in Australia (*H. chelodinae*). Wenyon (1926) moved the reptilian haemoproteids to the genus *Haemoproteus*, while Mackerras (1961) and Garnham (1966) returned to the use of *Haemocystidium* for species from reptilian hosts. Garnham (1966) also created a new genus, *Simondia*, for haemoproteids of chelonians.

The main characteristic used to differentiate *Haemocystidium* from *Haemoproteus* : the oval rather than halteridium-like gametocyte (Castellani & Willey, 1904; Shortt, 1922; Mackerras, 1961) is a persistant characteristic only in part of the reptilian haemoproteids, in the rest, oval gametocytes occur concurrently with halteridial ones, and there are also species which form exclusively halteridial gametocytes. Moreover, in some species, for example *H. underwoodsauri*, one sex gametocytes are oval while the other sex gametocytes are halteridian.

List of haemoproteid species from squamous reptiles

Geckoes, Australia : *H. mackerrasi* n. sp.; *H. gehyrae* n. sp; *H. oedurae* n. sp.; *H. underwoodsauri* n. sp.

Geckoes, Mediterranean : *H. tarentolae* (Parrot, 1927); *H. ptyodactyli* n. sp.

Source : MNHN, Paris

GECKOES, INDO-IRAN : *H. simondi* (Castellani & Willey, 1904); *H. kopki* (de Mello, 1916); *H. phyllodactyli* Shortt, 1922.

AGAMID LIZARDS, EAST MEDITERRANEAN-IRANO-TURKESTAN : *H. grahmi* Shortt, 1922; *H. edomensis* n. sp.

AGAMID LIZARDS, AFRICA : *H.* spp. of MACFIE, 1914; of BRAY, 1959; of BALL, 1967.

ENDEMIC LIZARDS, MADAGASCAR : *H. opluri* n. sp; *H.* cf. *opluri.*

SNAKES, AFRICA : *H. mesnili* (Bouet, 1909); *H. najae* (Wenyon, 1909).

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Prokoenenia millotorum Remy, type du nouveau genre *Triadokoenenia* (Arachnida, Palpigradida)

par Bruno Condé

Résumé. — Un nouvel examen du Palpigrade malgache *Prokoenenia millotorum* Remy conduit á la création de *Triadokoenenia* n. gen., sur la base de deux caractéres exclusifs : perte de l'organe frontal médian et présence, chez le mâle, de trois paires de fusules.

Abstract. — A new examination of the malagasy Palpigrade *Prokoenenia millotorum* Remy leads to the erection of *Triadokoenenia* n. gen. on the basis of two exclusive characters : the loss of the mid frontal organ and a third pair of spinnerets in male.

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Ce travail est dédié à la mémoire de Mademoiselle P. Coine, collaboratrice du Laboratoire de Zoologie de 1961 à 1990.

Introduction

Sous le nom de *Prokoenenia millotorum*, Remy (1950 : 136) a décrit un singulier Palpigrade qu'il avait récolté á Madagascar, en 1947, dans la Réserve naturelle de Lokobe sur l'île de Nosy Be et á Tuléar. La description ne prend en compte que les adultes (6 mâles et 3 femelles); les juvéniles (7) qui devaient être étudiés ultérieurement ne l'ont pas été.

Conformément á la définition de *Prokoenenia*, les adultes possédent une paire de vésicules exsertiles sur chacun des sternites IV, V et VI de l'opisthosome, mais ils présentent en outre deux caractéres remarquables : absence de l'organe frontal médian du prosome et présence d'une troisiéme paire de fusules au premier volet génital du mâle.

Ces deux particularités écartant l'espéce de tous les autres Palpigrades actuels [1], il semble légitime de lui accorder un statut générique distinct, plus proche de *Prokoenenia* que des autres genres.

1. Le fossile *Paleokoenenia mordax* Rowland et Sissom, 1980, ne peut être comparé, les critéres concernés n'ayant pas pu être observés chez cette espéce.

Source : MNHN, Paris

Matériel et méthodes

Le matériel, conservé au Laboratoire de Zoologie (Arthropodes) du Muséum national d'Histoire naturelle, qui m'a été aimablement communiqué par M^me^ J. Heurtault, se composait de 15 spécimens (7 mâles, 3 femelles, 5 juvéniles), tous de Lokobe. Douze d'entre eux avaient été montés sur lame dans de l'eau glycérinée, après passage à la potasse, et se trouvaient à sec; dans plusieurs cas, la lamelle s'était détachée, mais le spécimen était resté sur la lame et il fut ainsi possible de remonter onze individus dans le médium Il de Marc André. Un juvénile inclus dans un médium synthétique (? polyvinyl) n'a pu en être extrait. Deux spécimens enfin étaient en alcool. Aucun type n'était désigné.

Stations et identifications des spécimens révisés

Réserve naturelle de Lokobe : Ravin d'Ankirika (station 109; 04.09.1947) : 2 mâles (n^os^ 2, 3), 1 imm. *A2* (en alcool, sans n°); Ravin d'Antsaravy (station 110; 05.09.1947) : 3 mâles (n^os^ 98, 99, 100), 1 imm. *A2* (n° 101); Ravin d'Ambolotsoa (stations 112 et 117; 06 et 08.09.1947) : 1 mâle (n° 112-1), 2 femelles (n^os^ 112-7 et 117-6), 1 imm. *A2* (112-103); Ravin d'Andranovazaka (station 119; 08.09.1947) : 1 mâle (n° 104), 1 imm. (n° 106, indémontable), ces deux spécimens non cités dans la description originale. — Nosy Be (09.1947) : 1 femelle (en alcool, sans n°).

Au total 14 exemplaires : 7 mâles, 3 femelles, 3 imm. *A2*, 1 imm. indéterminable.

Le mâle 110-99 est choisi comme lectotype, les autres adultes sont tous paralectotypes.

TRIADOKOENENIA n. gen.

Diagnose : Prosoma sans organe frontal médian; 10 + 10 phanères sur le bouclier; tibia IV sans trichobothrie; basitarse IV avec 4 phanères (2 *esd*, *grt*, *r*). Opisthosoma pourvu de vésicules exsertiles sur les sternites IV à VI (adultes) qui ne possèdent chacun qu'une seule paire de phanères glandulaires parasagittaux; trois paires de fusules au premier volet génital du mâle. Réceptacle séminal de la femelle cupuliforme. Un stade postembryonnaire *A2*.

Étymologie : Du grec *trias*, *ados*, le nombre 3, en référence aux trois paires de fusules du mâle.

Espèce-type, par monotypie : *Prokoenenia millotorum* Remy, 1950.

Triadokoenenia millotorum (Remy, 1950)

Compléments à la description originale

Longueurs. — *Mâles* : Corps : 0,91-1,31 mm (Remy); bouclier prosomien : 0,24; 0,28 mm; tibia IV : 91; 95,5; 95,6; 96,5; 102; 103 µm; $\bar{X}$ = 97,35 µm; basitarse IV : 61; 61,7; 62; 64; 65; 67,5 µm; $\bar{X}$ =

Source : MNHN, Paris

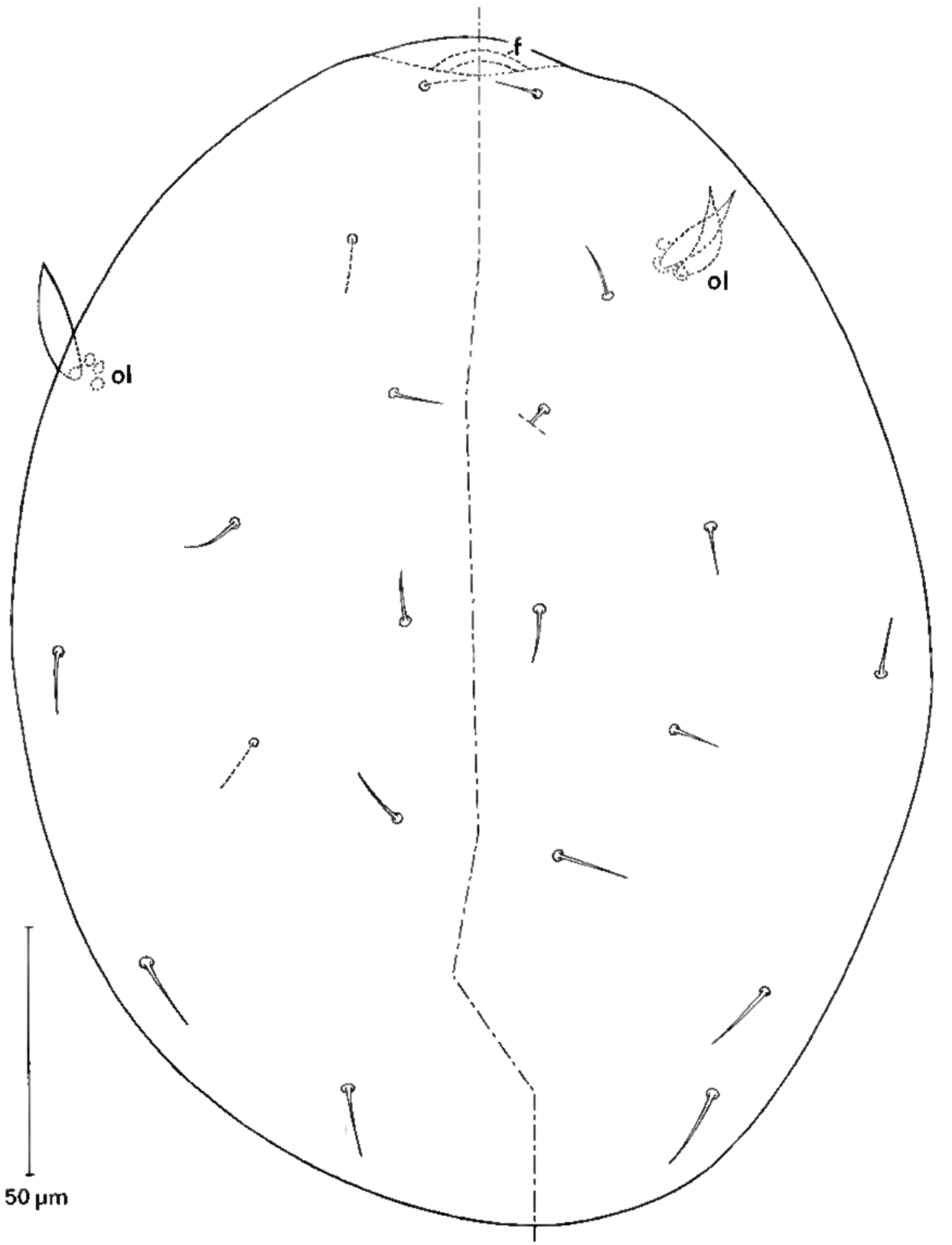

FIG. 1. — *Triadokoenenia millotorum* (Remy, 1950), femelle adulte paralectotype (117-6), ravin d'Ambolotsoa (Nosy Be, Réserve de Lokobe). Bouclier prosomien. *f* = formation frontale non identifiée ; *ol* = organe latéral.

Source : MNHN, Paris

63,56 µm. — *Femelles* : Corps : 0,80-0,91 mm (REMY); bouclier prosomien : 0,28 mm; tibia IV : 97,75; 101; 101 µm; $\bar{X}$ = 99,9; basitarse IV : 63,5; 65,5; 67 µm; $\bar{X}$ = 65,3 µm. — *Immatures A2* : Corps : 0,75 mm (en extension); bouclier prosomien : 0,18; 0,19; 0,20 mm; tibia IV : 61,5; 64,5 µm; basitarse-IV : 41; 44 µm[1].

Adultes

Prosoma

REMY (1950 : 136) a mis en doute l'existence d'un organe frontal médian [2]; à mon tour, je n'ai pas trouvé trace de cet organite que sa forme en diapason rend facilement identifiable, même en vue de profil, et je puis conclure à son absence effective. Dans un cas très favorable (femelle 117-6) on distingue, à la face sternale du bouclier, un peu en avant des phanères de la paire antérieure, une formation cuticulaire légèrement arquée vers l'arrière qui se déforme selon le niveau de mise au point : au plan le plus sternal, c'est une simple ligne réfringente, tandis qu'au plan tergal elle se présente comme une bandelette d'environ 1,3 µm de large, ce qui pourrait correspondre à une section triangulaire. Je ne puis préciser davantage, mais cette formation ne peut pas correspondre à l'embase d'un organe frontal qui aurait été arraché. Les organes latéraux (4 éléments chacun) ont été bien décrits par REMY (1950 : 136 et fig. 1, 1).

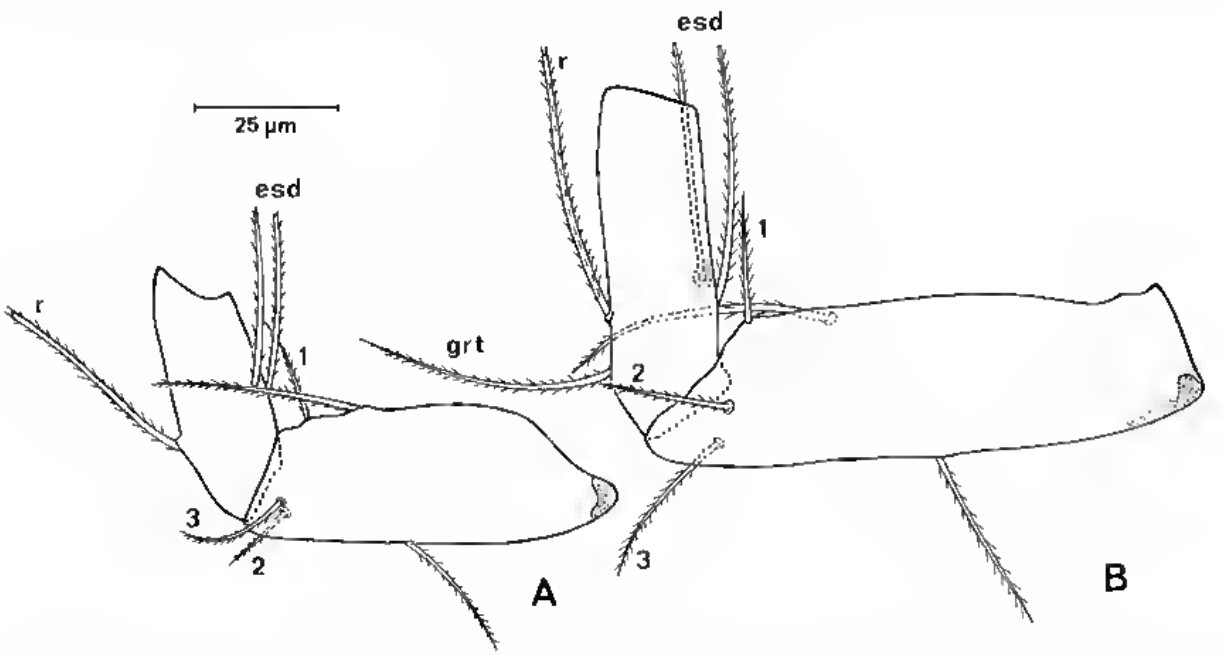

FIG. 2. — *Triadokoenenia millotorum* (Remy, 1950), tibia et basitarse IV : A, immature *A2* (109-sans n°), ravin d'Ankirika (Nosy Be, Réserve de Lokobe); B, femelle adulte paraleclotype de Nosy Be (09.1947, sans autre précision). 1 à 3 = phanères subapicaux du tibia; *esd* = soies épaisses sternales distales; *grt* = soie grêle tergale; *r* = soie raide.

1. Les pattes IV du spécimen 112-103 manquent.
2. « Organe frontal médian non vu (absent?) ».

Source : MNHN, Paris

Bouclier avec 10 + 10 soies de longueurs moyennes, disposées comme chez *Eukoenenia*, celles des paires latéro-postérieures un peu plus longues. Segment libre avec 3 paires de phanères, les intermédiaires (t_2 = 73) plus longs et plus épais que les médiaux (t_1 = 53), eux-mêmes plus longs que les latéraux (t_3 = 45). La variation des phanères du deuto-tritosternum (13 à 15 chez les mâles, 14 ou 15 chez les femelles selon REMY), chez les spécimens où elle est encore observable sans ambiguïté, est la suivante : 6/7 (2 cas), 6/8 (1 cas), 7/8 (3 cas).

8 dents aux mors des chélicères et 3 longs phanères barbelés sur l'article basal.

Tibia IV avec 5 phanères ordinaires : un tergal inséré vers le milieu du bord correspondant ; un sternal, vers le quart distal, ce phanère étant le plus long et le plus robuste ; trois subapicaux courts. Longueurs relatives moyennes des phanères, dans l'ordre : 42 ; 63,25 ; 31,75 ; 27,20 ; 34. Basitarse IV plus court que le tibia (bta/ti = 0,65), 3 fois à 3 fois 1/2 aussi long que large et sans pseudoarticulation. 4 phanères (2 *esd, gtr, r*) ; t/r : $\bar{X}$ = 1,21 (extrêmes : 1,12-1,33) ; t/er : $\bar{X}$ = 2,81 (extrêmes 2,53-3). Ces valeurs sont en accord avec la diagnose originale (soie raide égale au 7/8 du bord tergal et insérée vers le 1/3 proximal de ce bord).

Opisthosoma

Les rares tergites encore lisibles, quoique très difficilement, portent 2 paires de soies (t_1, t_3), les t_1 un peu plus courtes que leur écartement (45/50) et que les t_3 (48) ; une paire de soies grêles latérales (*s*). Segments IX à XI avec respectivement 10 (4 + *t* + 4 + *s*), 7 (4 + *s* + 4) et 8 (4 + 4) poils.

Mâle : Les volets génitaux ont été bien décrits et figurés par REMY (1950 : 139 et fig. 2) ; on notera la racine des fusules, dont la paroi est presque aussi épaisse et sclérifiée que celle de la tige, qui pénètre profondément dans le volet à la rencontre du fin canal glandulaire, disposition qui m'est inconnue chez les autres Palpigrades.

Femelle : REMY (1950 : 137) a décrit les volets génitaux et figuré le premier d'après la femelle 117-6 (*loc. cit.* : fig. 1, 3), ce qui apparaît clairement à l'examen des points précis d'implantation de certains phanères. Ce volet appartient au type 11 + 11 (a_4 présents) ; chez la femelle 112-7, deux orifices glandulaires paramédians sont extrêmement visibles à la face interne du volet (g_1 *in* CONDÉ, 1990, fig. 6 A, *Prokoenenia javanica*) ; ils sont aussi présents, mais très discrets, chez la femelle 117-6. Le troisième volet, non représenté par REMY, porte sur chaque moitié les 3 phanères habituels, *x* (55-58), distinctement plus long que *y* et *z* (52, 43). Dans la région postéro-médiane des volets, des sclérifications forment l'image d'une coupe pédonculée ou d'un calice avec, en profondeur, un réceptacle sphérique à paroi mince ; en avant, dans les régions latérales, des formations subcirculaires à région centrale déprimée et granuleuse, très visibles chez l'individu 112-7 (5 + 7), qui peuvent être interprétées comme des orifices glandulaires ou des plaques d'évaporation (*ogl*).

Sternites IV à VI identiques entre eux, avec une paire parasagittale de gros phanères glandulaires *a*, tronqués à l'apex. Une paire de massifs glandulaires subcirculaires, contigus sur la ligne médiane et sous-jacents aux phanères a_1, a été vue distinctement au sternite IV de l'immature *A2* de la station 109 qui était fixé dans l'alcool. Cette formation a disparu après séjour dans le Marc André II. Une soie grêle ($\omega = s_1$ de REMY), plus courte que a_1, s'insère au bord interne de l'orifice de la vésicule exsertile ; une soie plus épaisse ($l = s_2$ de REMY), en avant de l'orifice de la vésicule et sur la moitié externe de cette formation ou en son milieu, et les deux soies grêles latérales (s_1, s_2) habituelles.

Source : MNHN, Paris

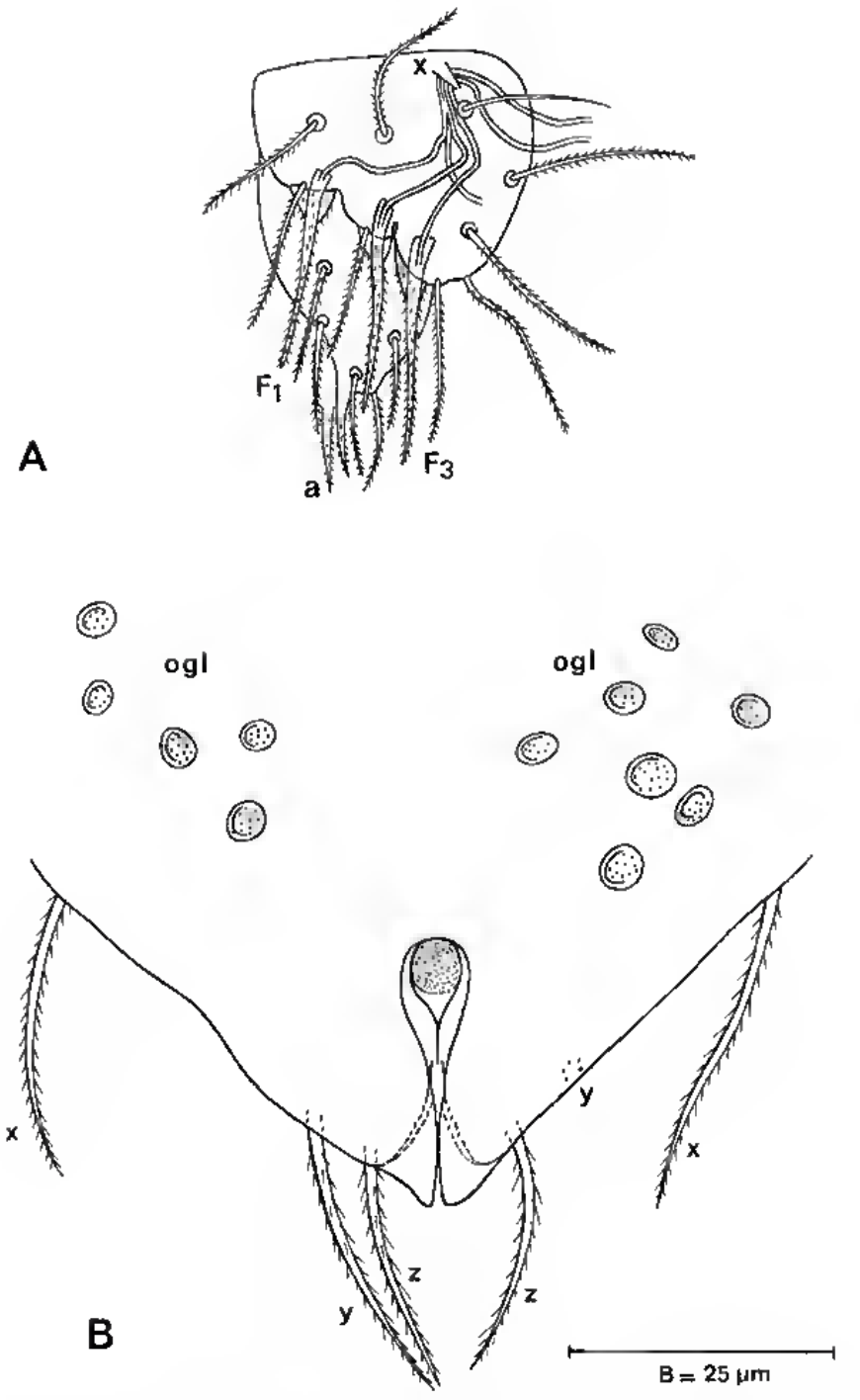

FIG. 3 — *Triadokoenema millotorum* (Remy, 1950) : A, mâle adulte, lobes gauches des volets génitaux, d'après REMY, légèrement modifié (*a* = pointe du 3e volet ; F_1—F_3 = fusules ; *x* = point où les canaux évecteurs n'ont pu être suivis) ; B, femelle adulte paralectotype, deuxième volet génital, figure composite : les formations subcirculaires (*ogl*) sont empruntées au spécimen 112-7 et le reste au spécimen 117-7. *x*, *y*, *z* = phanères proximal et distaux.

Source : MNHN, Paris

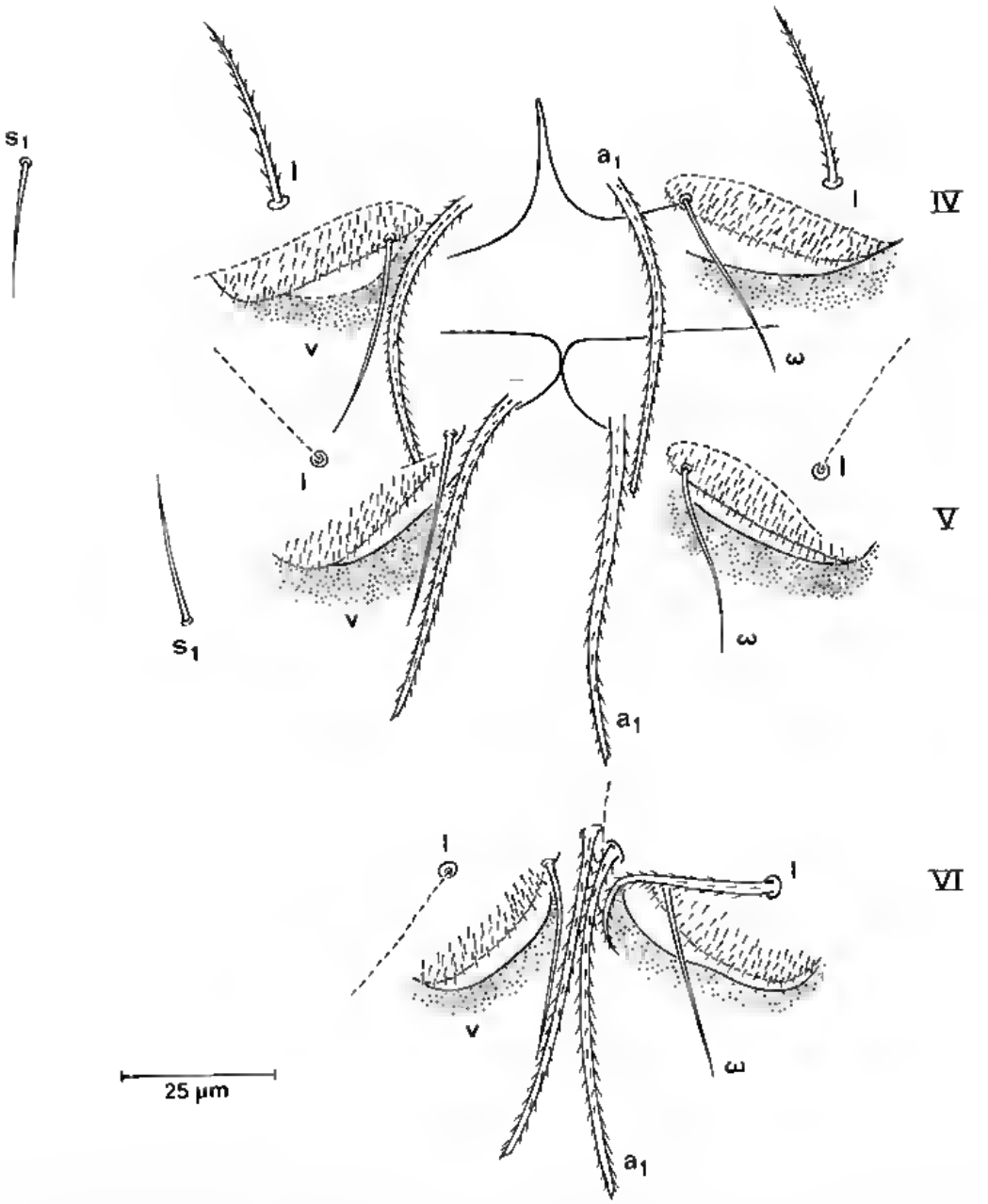

FIG. 4. — *Triadokoenenia millotorum* (Remy, 1950), mâle adulte paralectotype (112-1), ravin d'Ambolotsoa (Nosy Be, Réserve de Lokobe) Sternites IV à VI de l'opisthosome. a_1 = phanère glandulaire; l = phanère latéral; s_1 = phanère grêle pleural; v = orifice de la vésicule exsertile; ω = phanère grêle du bord interne de l'orifice de la vésicule exsertile.

Source : MNHN, Paris

Immature A2

Prosoma

Organes latéraux avec 2 éléments chacun. 7 phanères au deuto-tritosternum, 3 en V et 2 + 2 en un rang transversal. 7 dents aux mors des chélicères.

Tibia IV comme celui de l'adulte. Basitarse IV plus court que le tibia (bta/ti = 0,67), sans soie grêle tergale (*grt*), les 3 phanères étant les deux soies épaisses sternales distales (*esd*) et la soie raide (*r*); t/r = 0,97; 1,15; t/er = 3,17; 2,68 (les valeurs extrêmes, 0,97 et 3,17, se rapportent au même basitarse)

Opisthosoma

Le sternite II présente une échancrure médio-postérieure délimitant deux lobes qui portent chacun une paire de soies. Sternite III avec 3 + 3 phanères, les médiaux (st_1) insérés de part et d'autre d'une échancrure comparable à celle du sternite II, les deux autres paires (st_2, st_3) situées latéralement, l'ensemble formant une rangée transverse. Sternites IV et V semblables à ceux des adultes; les phanères a_1, ω et *l* sont présents, de même que les vésicules exsertiles. En VI, il n'y a pas de vésicules, mais les phanères des sternites précédents se retrouvent.

Un flagelle incomplet, long de 0,40 mm, compte 8 articles et une moitié du 9e, avec un verticille apical de longues épines aux articles I à III, V et VII.

Discussion

Ce stade a été décrit par Rucker (1903) chez sa *Prokoenenia wheeleri* comme « second stage », sur deux spécimens seulement, alors qu'elle disposait de quelque 90 individus du « first known stage ». Depuis, ce stade sexuellement indifférencié qui n'a pas d'équivalent connu chez les autres Palpigrades, n'avait pas été retrouvé. Dans l'incertitude, je l'avais considéré (1984*a* : 141 ; 1984*b* : 389-390) comme un dédoublement possible du stade *A*, en proposant la notation *A1*, *A2*, mais en évoquant aussi la nature, peut-être accidentelle, de *A2* celle-ci pouvant expliquer sa rareté. Il est donc remarquable que les trois immatures identifiables de la présente espèce lui appartiennent et confirment l'existence de cette étape peu connue jusqu'ici.

Conclusion

D'une comparaison entre *Prokoenenia javanica* Condé, 1990, l'espèce la mieux connue de ce genre, et *Triadokoenenia millotorum*, il ressort que la plupart des caractères distinctifs du nouveau genre sont, le plus vraisemblablement, dérivés : perte de l'organe frontal, acquisition d'une troisième paire de fusules, basitarse IV à 4 phanères sans pseudoarticulation, sternites IV à VI à chétotaxie minimale (une seule paire de phanères *a*) de l'immature *A2* à l'adulte. En revanche, le phanère tergal ordinaire du tibia IV, remplacé par une trichobothrie chez *P. javanica*, semble être un critère généralisé, comme les caractères de l'aire génitale femelle. *Leptokoenenia* et une vingtaine d'espèces de *Eukoenenia* ont aussi un basitarse à 4

Source : MNHN, Paris

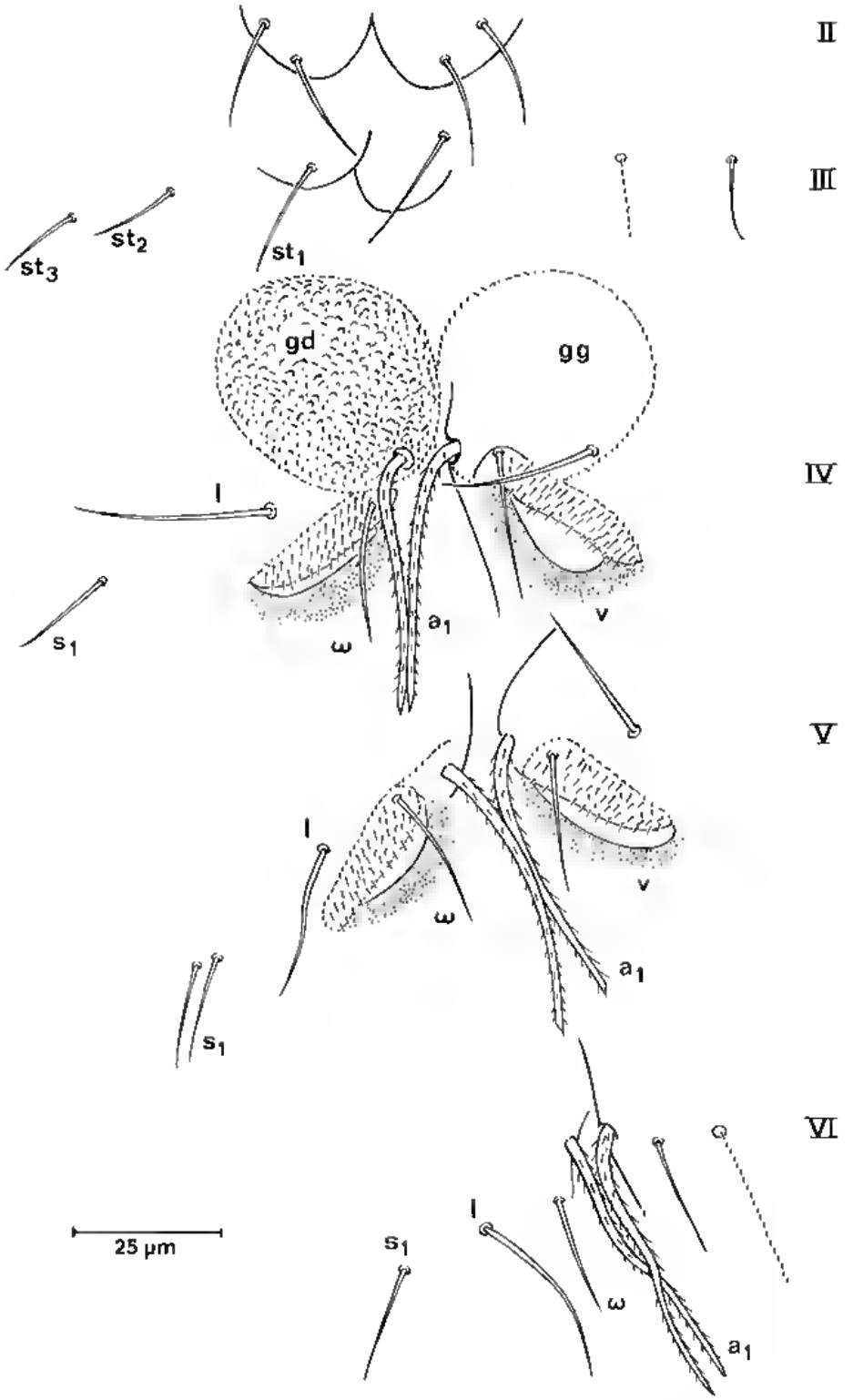

FIG. 5. — *Triadokoenenia millotorum* (Remy, 1950), immature *A2* (112-103), ravin d'Ambolotsoa (Nosy Be, Réserve de Lokobe). Sternites II à VI de l'opisthosome. Explication des lettres comme pour la figure 4, sauf : st_1-st_3 = phanères du sternite III et *gd*, *gg* = massifs glandulaires droit et gauche du sternite IV (empruntés à l'immature de la station 109).

Source : MNHN, Paris

phanères, semblable à celui de leurs immatures *B* ou *C*, ce qui évoque un arrêt de développement par rapport aux types à 7 phanères qui sont plus nombreux (CONDÉ, 1991).

L'existence du stade supplémentaire *A2* rapprocherait les deux genres prokoenéniens d'un ancêtre hypothétique à six stades, inféré par VAN DER HAMMEN (1982 : 20, 48) d'une comparaison avec les Acariens Actinotrichida. Les vésicules exsertiles qui dériveraient d'appendices opisthosomiens ancestralement perdus (VAN DER HAMMEN, 1982 : 20, 48) réapparaissent progressivement au cours du développement postembryonnaire de ces deux genres. Les représentants des lignées eukoenéniennes, dépourvus de stade *A2* et de vésicules, seraient ainsi des formes néoténiques.

Remerciements. — Je remercie très vivement M^me^ Jacqueline HEURTAULT pour son assistance et M. Jacques REBIÈRE pour la mise au propre de l'illustration.

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Source : MNHN, Paris

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Nouveaux *Trechus* et *Stevensius* du Népal Oriental (Insecta, Coleoptera, Trechidae) [1]

par Thierry DEUVE et Gilbert HODEBERT

Résumé. — Liste des Coléoptères Trechidae Trechinae récoltés au Népal par le Pr. MARTENS. Descriptions de quelques espèces nouvelles du Népal Oriental : *Trechus simbuaensis* n. sp., *T. tamurensis* n. sp., *T. schawalleri* n. sp., *T. martensi* n. sp., *Stevensius bidulus* n. sp.

Abstract. — List of Coleoptera Trechidae Trechinae collected by Pr. MARTENS in Nepal. Descriptions of some new species from Oriental Nepal : *Trechus simbuaensis* n. sp., *T. tamurensis* n. sp., *T. schawalleri* n. sp., *T. martensi* n. sp., *Stevensius bidulus* n. sp.

Mots-clefs. — Insecta, Coleoptera, Trechidae, *Trechus*, *Stevensius*, taxonomie, Nepal, Himalaya.

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La partie orientale du Népal, à l'est de la rivière Arun, semble la plus riche de ce pays en espèces de Coléoptères Trechidae de la sous-famille des Trechinae. Cette région est d'un accès difficile, mais les quelques expéditions entomologiques qui y ont été effectuées, sous la forme de longs trekkings loin de toute route, ont toujours permis la découverte de nombreuses espèces, nouvelles pour la science.

Les premières récoltes recensées de Trechinae sont dues à une équipe japonaise, qui a prospecté en 1962, près de Kangbachen, les abords méridionaux du mont Kangchenjunga (UÉNO, 1973), tandis que la même année Ph. DREUX récoltait lui aussi des Coléoptères Carabiques dans le Jaljale Himal, au cours de l'expédition « Jannu ». En 1980 et 1984, P. MORVAN a effectué de longs périples dans cette même région, entre Tumlingtar et Taplejung, et en 1989 à Tombe Pokhari à la frontière du Sikkim. En 1982, A. et S. SMETANA ont colligé des Trechinae issus des environs de Kandbari dans la vallée de l'Arun (DEUVE, 1988) et, en 1983, Th. DEUVE, E. KREJCI, M. PERREAU et E. QUÉINNEC ont récolté des Insectes de tous ordres, parmi lesquels de nombreux Trechinae nouveaux, dans l'ouest du Népal Oriental, entre les vallées de l'Arun et de la Tamur, jusqu'à la zone alpine du Milke Himal, à 4500 m d'altitude (DEUVE & QUÉINNEC, 1985). C'est en 1988, que le Pr. J. MARTENS (Mayence) et le Dr W. SCHAWALLER (Stuttgart) ont fait un long trekking à travers les montagnes situées à l'est de la rivière Tamur puis, après avoir prospecté la zone alpine jusqu'à 5000 m, sont

1. Résultats des Expéditions himalayennes de J. MARTENS, n° 173 (n°172 : *Revue suisse Zool.*, 98 (4), 1991). J. M. sponsorisé par le *Deutscher Akademischer Austauschdienst* et la *Deutsche Forschungsgemeinschaft*.

Source : MNHN, Paris

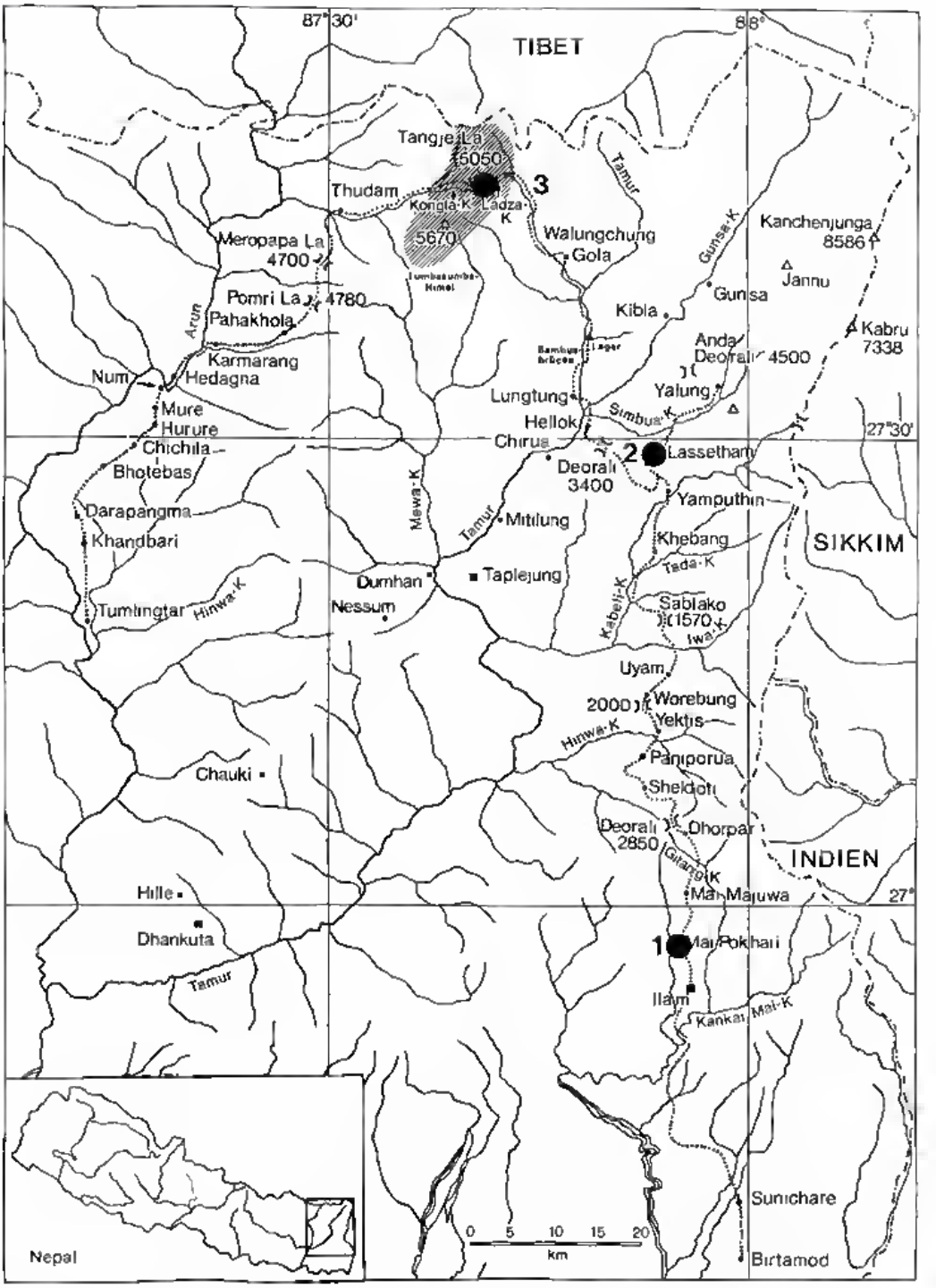

FIG. 1. — Itinéraire de l'expédition de J. MARTENS et W. SCHAWALLER dans le Népal Oriental en 1988 (*ligne en pointillé*). Localités typiques des espèces nouvelles : *Trechus simbuaensis* n. sp. (2), *T. tamurensis* n. sp. (2), *T. schawalleri* n. sp. (1), *T. martensi* n. sp. (3) et *Stevensius bidulus* n. sp. (2).

Source : MNHN, Paris

redescendus par la vallée de l'Arun. L'itinéraire de cette expédition est indiqué sur la figure 1. A notre connaissance, ce fut alors la première fois que des naturalistes prospectèrent ces très hautes altitudes situées au nord à quelques kilomètres seulement de la frontière du Tibet. Ce sont les Trechinae récoltés au cours de ce dernier voyage qui nous ont été communiqués par le Dr SCHAWALLER, que nous remercions très vivement pour cette marque de confiance. La liste en est donnée ci-après, avec les descriptions de cinq espèces nouvelles. Les holotypes sont déposés au Muséum d'Histoire Naturelle d'État de Stuttgart.

Nous avons joint à cette liste les Trechinae récoltés au cours d'autres expéditions du Pr. MARTENS, en 1980 (J. MARTENS et A. AUSOBSKY), en juillet-août 1983 (J. MARTENS et W. SCHAWALLER) et en août-septembre 1983 (J. MARTENS et B. DAAMS), dans d'autres régions du Népal.

L'étude de ces nombreux Trechinae confirme ce que l'on connaissait déjà de leur distribution altitudinale dans l'Himalaya (DEUVE, 1987, 1988). Le genre *Trechus* Clairville est un élément paléarctique, mais deux espèces ailées à vaste répartition de l'étage montagnard, *T. indicus* Putzeys et *T. championi* Jeannel, descendent dans la zone tropicale (figurent en particulier dans le matériel du Muséum de Stuttgart des spécimens de *T. indicus* qui ont été capturés à 1000 m d'altitude dans le district de Taplejung). Les autres espèces, des genres *Trechus* Clairville et *Stevensius* Jeannel, sont aptères, plus localisées, et strictement inféodées à un étage altitudinal déterminé : forêts de Feuillus de la zone montagnarde (environ 2000-3000 m), forêts à *Abies* et *Rhododendron* de la zone subalpine (3000-4000 m) ou pelouses alticoles de la zone alpine (4000-5000 m).

LISTE DES ESPÈCES

1. **Trechus indicus** Putzeys

PUTZEYS, 1870, *Stett. ent. Z.*, 31 : 175, Type : « Indes Orientales ».

Espèce à très vaste répartition dans tout l'Himalaya et l'Hindu-Kuch, depuis l'Afghanistan (*kabakovi* Pawlowsky) jusqu'au Yunnan (*macrops* Jeannel). Souvent à basse altitude et même parfois franchement dans la zone tropicale : signalée de 950 à 3100 m.

MATÉRIEL EXAMINÉ : Distr. Kathmandou, Mt Sheopuri, 2100-2300 m (J. MARTENS et W. SCHAWALLER). — Distr. Kathmandou, Ganabahal, 1350 m (J. MARTENS et A. AUSOBSKY). — Distr. Kasbi, au-dessus de Dhumpus, 2100 m (J. MARTENS et A. AUSOBSKY). — Distr. Terhatum, au-dessus de Nessum, 1350 m (J. MARTENS et B. DAAMS). — Distr. Sankhua Sabha, vallée de l'Arun entre Mure et Hurure, 2050-2150 m (J. MARTENS et W. SCHAWALLER). — Distr. Sankhua Sabha, vallée de l'Arun, Chichila, 1900-2000 m (J. MARTENS et W. SCHAWALLER). — Distr. Taplejung, au-dessus de la vallée de la Tamur, des chutes de Lungthung au pont de bambou, 1800-2150 m (J. MARTENS et W. SCHAWALLER). — Distr. Taplejung, vallée de la Kabeli Khola, jusqu'à la confluence de la Tada Khola, 950-1050 m (J. MARTENS et W. SCHAWALLER). — Distr. Panchthar, Paniporua, 2300 m (J. MARTENS et W. SCHAWALLER). — Distr. Ilam, Mai Pokhari, 2100-2200 m (AUSOBSKY, J. MARTENS, W. SCHAWALLER).

Source : MNHN, Paris

2. **Trechus championi** Jeannel

JEANNEL, 1920, *Ann. Mag. nat. Hist.*, (9), **5** : 109. Type : Inde, Nainital.

Espèce largement répandue dans l'Himalaya, depuis le Pundjab jusqu'au Sikkim, descendant aussi parfois dans la zone tropicale : signalée de 1300 à 3000 m d'altitude.

MATÉRIEL EXAMINÉ : Distr. Taplejung, au-dessus de la vallée de la Tamur, des chutes de Lungthung jusqu'au pont de bambou, 1800-2150 m (J. MARTENS et W. SCHAWALLER). — Distr. Taplejung, Omje Kharka, au nord-ouest de Yamputhin, 2300-2500 m (J. MARTENS et W. SCHAWALLER). — Distr. Ilam, Mai Pokhari, 2100-2200 m (J. MARTENS et W. SCHAWALLER). — Distr. Ilam, au nord de Mai Pokhari, 2000-2400 m (J. MARTENS et A. AUSOBSKY). — Distr. Ilam, Gitang Khola, 1750 m (J. MARTENS et W. SCHAWALLER).

3. **Trechus besuchetianus** Deuve

DEUVE, 1987, *Nouv. Revue Ent.*, n.s., **4** : 86. Holotype : Népal Central, massif des Annapurna, col de Ghorepani, 2850 m (I. LÖBL, A. SMETANA).

Cette espèce n'était connue que de sa localité typique. Elle a été retrouvée dans la même région par J. MARTENS et A. AUSOBSKY.

MATÉRIEL EXAMINÉ : Distr. Parbat, entre Chitre et Ghandrung, versant du col vers Chitre, 2800-3050 m (J. MARTENS et A. AUSOBSKY).

4. **Trechus simbuaensis** n. sp.

(Fig. 2)

Holotype : 1 ♂, Népal Oriental, District de Taplejung, crête de Lasse Dhara et prairie de Lassetham, forêt à *Abies* et *Rhododendron*, 3000-3300 m (J. MARTENS et B. DAAMS leg., 6-7 septembre 1983), *in* coll. Staatliches Museum für Naturkunde, Stuttgart. Paratypes *in* coll. Staatl. Mus. f. Naturk. Stuttgart et Muséum national d'Histoire naturelle de Paris : 11 exemplaires de la même provenance que l'holotype ; 8 exemplaires du District de Panchthar, Paniporua, 2300 m (J. MARTENS et W. SCHAWALLER, 16-20 avril 1988) ; 2 exemplaires du District de Panchthar, Mai Majuwa Khola, Dhorpar Kharka (J. MARTENS et B. DAAMS, 27-28 août 1983) ; 47 exemplaires du District de Taplejung, haute vallée de la Simbua Khola, environs de Tseram, forêt à *Abies* et *Rhododendron*, 3250-3350 m (J. MARTENS et W. SCHAWALLER, 10-15 mai 1988) ; 1 exemplaire du District de Taplejung, haute vallée de la Simbua Khola, environs de Yalung, forêt à *Abies, Rhododendron* et *Juniperus*, 3450-3700 m (J. MARTENS et W. SCHAWALLER, 13 mai 1988) ; 1 exemplaire du District de Taplejung, Yalung, vers Anda Deorali, 3500-3700 m (J. MARTENS et B. DAAMS, 9 septembre 1983) ; 5 exemplaires du District de Taplejung, haute vallée de la Simbua Khola, forêt à *Abies* et *Tsuga*, 2900-3100 m (J. MARTENS et W. SCHAWALLER, 15 mai 1988) ; 1 exemplaire du District de Taplejung, col de Deorali, à l'ouest de Yamputhin, 3400 m (J. MARTENS et W. SCHAWALLER, 17 mai 1988) ; 3 exemplaires du District de Taplejung, descente du col de Deorali à Hellok, 2800-3400 m (J. MARTENS et W. SCHAWALLER, 17 mai 1988) ; 5 exemplaires du District de Taplejung, au-dessus de Walungchung Gola, forêt ouverte à *Abies* et *Betula*, 3400-3600 m (J. MARTENS et W. SCHAWALLER, 21 mai 1988) ; 11 exemplaires du District de Sankhua Sabha, Thudam, forêt à *Abies* et *Betula*, 3550-3650 m (J. MARTENS et W. SCHAWALLER, 25-27 mai 1988) ; 2 exemplaires du District de Sankhua Sabha, entre

Source : MNHN, Paris

Pomri La et Pahakhola, forêt à *Abies* et *Rhododendron*, 3450-3600 m (J. MARTENS et W. SCHAWALLER, 30 mai 1988).

Longueur : 4,2-4,5 mm. Coloris brun sombre concolore, le clypéus ainsi que les zones marginales ou suturales plus ou moins roussâtres, les pattes et les antennes testacé rougeâtre, les palpes plus clairs, jaunâtres.

Tête moyenne, la capsule céphalique alutacée, les yeux pas plus saillants et à peine plus longs que les tempes, celles-ci convexes. Front large, peu convexe, un peu aplani, les sillons frontaux bien marqués, à peine anguleux. 1re soie frontale insérée dans une fossette profonde. Clypéus normalement quadrisétulé. Labre hexachète, à bord antérieur incurvé. Antennes avec le 3e article à peine plus long que les 2 et 4 qui sont sensiblement de même taille.

Pronotum 1,27 fois plus large que long, la plus grande largeur au tiers antérieur, les côtés seulement sinués juste avant les angles postérieurs qui sont saillants, droits ou subaigus. Disque assez convexe. Fossettes basales marquées, circulaires. Marges régulières, une soie au tiers antérieur, une seconde sur l'angle basal.

Élytres modérément convexes, les épaules assez larges et marquées, toutefois arrondies, les stries toutes visibles et assez profondes, imponctuées. Strie récurrente brusquement terminée à proximité mais sans continuité avec la 5e strie. Deux pores discaux sur le 3e interstrie, contre la 3e strie : le premier peu avant le quart basal de l'élytre, le second au milieu. Un troisième pore, préapical, sur la 2e strie, près de deux fois plus éloigné du sommet de l'élytre que de la suture.

Protibias sillonnés.

Édéage comme sur la figure 7, avec un aileron sagittal réduit. Endophallus sans pièce copulatrice, mais avec des formations écailleuses par endroit denses. Paramère avec une expansion basale appendiculiforme.

CARACTÈRES DIAGNOSTIQUES. — Espèce morphologiquement proche de *Trechus imaicus* Jeannel, mais le coloris plus sombre, sans irisation; les antennes à scape plus étroit et allongé mais à 3e article plus court; les stries élytrales un peu mieux marquées, imponctuées; l'édéage de même forme générale mais deux fois plus petit, la pointe apicale un peu plus large et émoussée.

5. **Trechus tamurensis** n. sp.
(Fig. 3)

Holotype : 1 ♂, Népal Oriental, District de Taplejung, Lassetham, au nord-ouest de Yamputhin, forêt à *Abies* et *Rhododendron*, 3300-3500 m (J. MARTENS et W. SCHAWALLER, 6-9 mai 1988), *in* coll. Staatliches Museum für Naturkunde, Stuttgart. Paratypes : 26 exemplaires, ♂♂ et ♀♀, même provenance, *in* coll. Staatl. Mus. f. Naturk. Stuttgart et Muséum national d'Histoire naturelle de Paris.

Mêmes caractères externes que *T. simbuaensis* n. sp., mais l'édéage différent : plus étroit, l'aileron sagittal davantage développé (fig. 8). Pronotum : lt/Lt = 1,40.

Source : MNHN, Paris

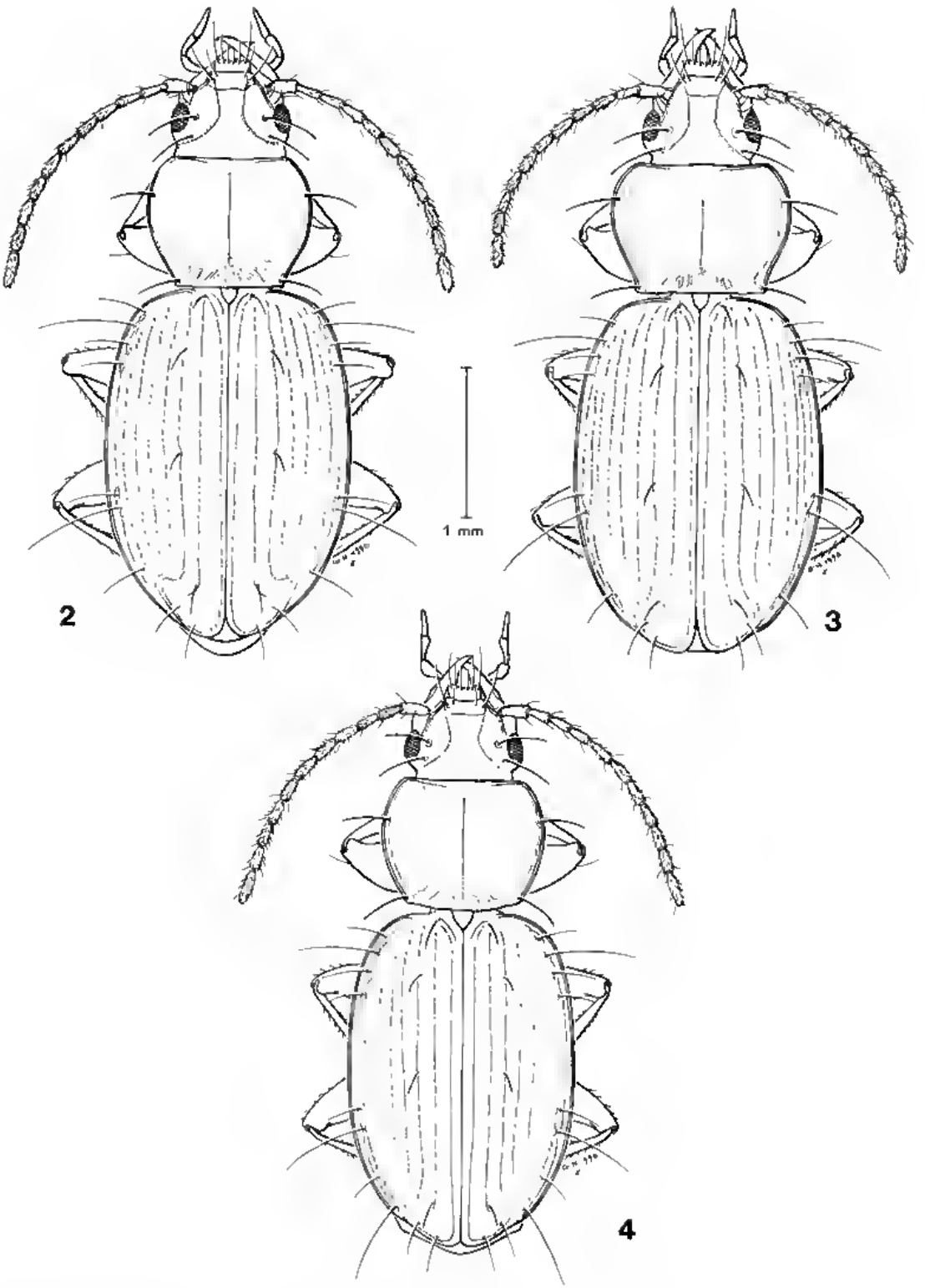

FIG. 2-4. — Habitus des espèces nouvelles, face dorsale : 2, *Trechus simbuaensis* n. sp. ; 3, *T. tamurensis* n. sp. ; 4, *T. schawalleri* n. sp.

Source : MNHN, Paris

6. **Trechus schawalleri** n. sp.
(Fig. 4)

Holotype : 1 ♂, Népal Oriental, District d'Ilam, Mai Pokhari, forêt à *Castanopsis*, 2100-2200 m (J. MARTENS et W. SCHAWALLER, 9-10 avril 1988), *in* coll. Staatliches Museum für Naturkunde, Stuttgart. Paratypes : 2 ♀, même provenance, *in* coll. Staatl. Mus. f. Naturk. Stuttgart et Muséum national d'Histoire naturelle de Paris.

Mêmes taille, coloration et caractères externes que les deux espèces précédentes, mais : 1) le pronotum moins transverse, seulement 1,25 fois plus large que long, à fossettes basales arrondies moins marquées, et à angles postérieurs obtus et émoussés ; 2) les stries élytrales un peu moins profondes et faiblement ponctuées ; 3) l'édéage différent, allongé (fig. 9). *T. schawalleri* semble remplacer ces deux espèces aux altitudes plus basses de l'étage montagnard, dans les forêts de Feuillus à la limite de la zone subtropicale.

7. **Trechus martensi** n. sp.
(Fig. 5)

Holotype ♂, Népal Oriental, District de Taplejung, montée vers Tangje La, nord-ouest de Walungchung Gola, en steppe sous des pierres sous la neige, 4800-5000 m (J. MARTENS et W. SCHAWALLER, 23 mai 1988), *in* coll. Staatliches Museum für Naturkunde, Stuttgart.

Longueur : 4,0 mm. Coloris brun, la tête un peu plus sombre, les appendices plus clairs, brun jaune testacé, les articles antennaires faiblement rembrunis.

Tête assez grosse, les yeux à peine plus convexes et plus longs que les tempes, celles-ci convexes. Sillons frontaux marqués, à peine anguleux. Clypéus normalement quadrisétulé. Labre hexachète, à bord antérieur incurvé. Mandibules assez courtes. Antennes avec les articles 2 et 3 sensiblement de même longueur, un peu plus longs que le 4e.

Pronotum 1,36 fois plus large que long, la plus grande largeur au quart antérieur, les côtés à peine subsinués puis redressés avant les angles postérieurs qui sont droits mais vifs et saillants. Disque peu convexe. Fossettes peu marquées, la plage basale bien délimitée, marquée de faibles ridulations longitudinales.

Élytres modérément convexes, les épaules arrondies, les quatre ou cinq premières stries bien visibles, assez profondes mais lisses, imponctuées, les suivantes effacées. Strie récurrente sans continuité avec la 5e strie. Rebord basal interrompu entre les origines des 4e et 5e stries.

Protibias non sillonnés. Édéage étroit, peu arqué, comme sur la figure 10.

CARACTÈRES DIAGNOSTIQUES. — Cette espèce, nivicole, est reconnaissable à sa tête un peu hypertrophiée, à la forme de son pronotum, à sa sculpture élytrale et à son édéage caractéristique. Elle rappelle par sa forme générale les autres espèces de très haute altitude qui sont connues du Népal Central.

Source : MNHN, Paris

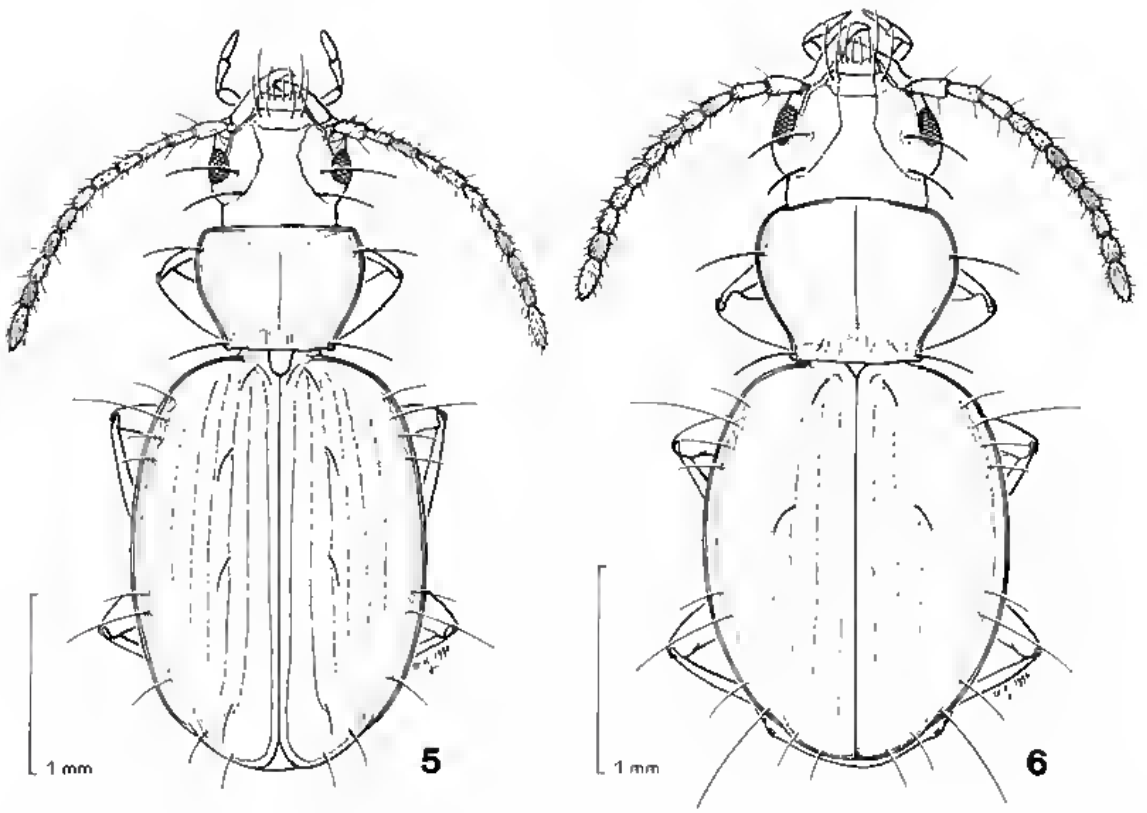

FIG. 5-6. — Habitus des espèces nouvelles, face dorsale : 5, *Trechus martensi* n. sp. ; 6. *Stevensius bidulus* n. sp.

8. **Trechus tosioi** S. Uéno

UÉNO, 1972, *Annotnes zool. japon.*, **45** : 179. Holotype : Népal Central, Gosainkund, 4300 m (T. KUMATA).

Espèce assez répandue dans les zones subalpine et surtout alpine de l'ouest du Népal Central, dans les massifs de Gosainkund, du Ganesh et du Manaslu (DEUVE & QUÉINNEC, 1985 ; DEUVE, 1988).

MATÉRIEL EXAMINÉ : Distr. Gorkha, Rupina La, versant sud, 4100-4500 m (J. MARTENS et W. SCHAWALLER).

9. **Trechus morvanianus** Deuve et Quéinnec

DEUVE & QUÉINNEC, 1985, *Nouv. Revue Ent.*, n.s., **2** : 341. Holotype : Népal Oriental, massif du Milke Himal, col de Deorali, 4050 m (T. DEUVE, E. KREJCI, M. PERREAU, E. QUÉINNEC).

Cette espèce strictement alpine a été retrouvée par l'expédition de J. MARTENS et W. SCHAWALLER dans plusieurs stations situées non loin de la localité typique.

Source : MNHN, Paris

Matériel examiné : Distr. Sankhua Sabha, descente de Pomri La, pente sud, 4450-4550 m (J. Martens et W. Schawaller). — Distr. Sankhua Sabha, entre Meropapa La et Pomri La, 4300-4550 m (J. Martens et W. Schawaller). — Distr. Sankhua Sabha, descente de Meropapa La à la rivière Yununtanga, 4600 m (J. Martens et W. Schawaller). — Distr. Sankhua Sabha, descente de la Gabri Khola vers Meropapa La, au sud de Thudam, 4300-4600 m (J. Martens et W. Schawaller). — Distr. Sankhua Sabha, de Thudam à la Gabri Khola, 4000-4250 m (J. Martens et W. Schawaller). — Distr. Sankhua Sabha, Kangla Khola, à l'est de Thudam, 4100-4200 m (J. Martens et W. Schawaller). — Distr. Taplejung, descente vers la Kangla Khola, à l'est de Thudam, 4500-4700 m (J. Martens et W. Schawaller). — Distr. Taplejung, au-dessus de Wakunhchung Gola, 3600-3800 m (J. Martens et W. Schawaller) — Distr. Taplejung, Ladza Kharka, vallée de la Ladza Khola, au nord-ouest de Walungchung Gola, 4100-4200 m (J. Martens et W. Schawaller). — Distr. Taplejung, au sud de Gunsa, 3600-3900 m (J. Martens et B. Daams).

10. **Stevensius striatulus** S. Uéno

Uéno, 1973, *Annotnes zool. japon.*, **46** : 61. Holotype : Népal Oriental, Khangbachen.

Espèce décrite de l'extrémité orientale du Népal, non loin du Sikkim.

Matériel examiné : Distr. Panchthar, Dhorpar Kharka, 2700 m (J. Martens et W. Schawaller). — Distr. Taplejung, col de Deorali, à l'ouest de Yamputhin, 3400 m (J. Martens et W. Schawaller). — Distr. Taplejung, prairie de Lassetham au nord-ouest de Yamputhin, 3300-3500 m (J. Martens et W. Schawaller). — Distr. Taplejung, crête de Lasse Dhara et prairie de Lassetham, 3000-3300 m (J. Martens et W. Schawaller.) — Distr. Taplejung, haute vallée de la Simbua Khola, près de Tseram, 3250-3350 m (J. Martens et W. Schawaller). — Distr. Taplejung, au-dessus de Walungchung Gola, 3400-3600 m (J. Martens et W. Schawaller).

11. **Stevensius bidulus** n. sp.
(Fig. 6)

Holotype : 1 ♂, Népal Oriental, District de Taplejung, crête de Lasse Dhara et prairie de Lassetham, forêt à *Abies* et *Rhododendron*, 3000-3300 m (J. Martens et B. Daams, 6-7 septembre 1983), *in* coll. Staatliches Museum für Naturkunde, Stuttgart. Paratypes *in* coll. Staatl. Mus. f. Naturk. Stuttgart et Muséum national d'Histoire naturelle de Paris : 4 exemplaires de la même provenance que l'holotype ; 2 exemplaires du District de Taplejung, haute vallée de la Simbua Khola, environs de Tseram, forêt à *Abies* et *Rhododendron*, 3250-3350 m (J. Martens et W. Schawaller, 10-15 mai 1988) ; 3 exemplaires du District de Taplejung, Lassetham, au nord-ouest de Yamputhin, forêt à *Abies* et *Rhododendron*, 3000-3500 m (J. Martens et W. Schawaller, 6-9 mai 1988) ; 1 exemplaire du District de Panchthar, Mai Majuwa Khola, Dhorpar Kharka, 2700 m (J. Martens et B. Daams, 27-28 août 1983).

Espèce de petite taille pour le genre (longueur : 3,7 mm), aux élytres courts et convexes, globuleux, la tête hypertrophiée. Coloris brun rougeâtre sombre, concolore, les pattes et antennes testacé rougeâtre, les palpes testacé jaune.

Tête très grosse, hypertrophiée mais non déformée, les yeux à peine plus convexes et de même longueur que les tempes, celles-ci convexes. Sillons frontaux continus et profonds. Deux paires de soies frontales ordinaires. Clypéus lisse, quadrisétulé. Labre hexachète, le bord antérieur fortement incurvé. Mandibule droite avec une unique dent rétinaculaire isolée, en position assez avancée. Mentum et submentum fusionnés. Formule antennaire : 2 > 3 > 4.

Source : MNHN, Paris

Pronotum 1,22 fois plus large que long, la plus grande largeur au tiers antérieur, puis trés rétréci en arrière, les côtés fortement redressés avant les angles postérieurs qui sont grands et vifs, droits ou subaigus. Disque trés convexe, lisse, le sillon médian peu visible. Fossettes basales petites et peu marquées, subcirculaires. Base rectiligne. Gouttières marginales étroites et réguliéres, les rebords finement relevés. Deux paires de soie marginales : l'une médiane, l'autre basale.

Élytre globuleux, en ovale court, davantage rétrécis en arriére qu'en avant, les épaules assez larges, arrondies. Disque trés convexe, les stries internes visibles mais imponctuées, les stries externes effacées. Une unique soie discale située vers le tiers basal de l'élytre, contre la 3e strie. Pas de soie préapicale.

Protibias sillonnés.

Édéage comme sur la figure 11, simple, la lame apicale non redressée, pas de piéce copulatrice individualisée. Aileron sagittal développé.

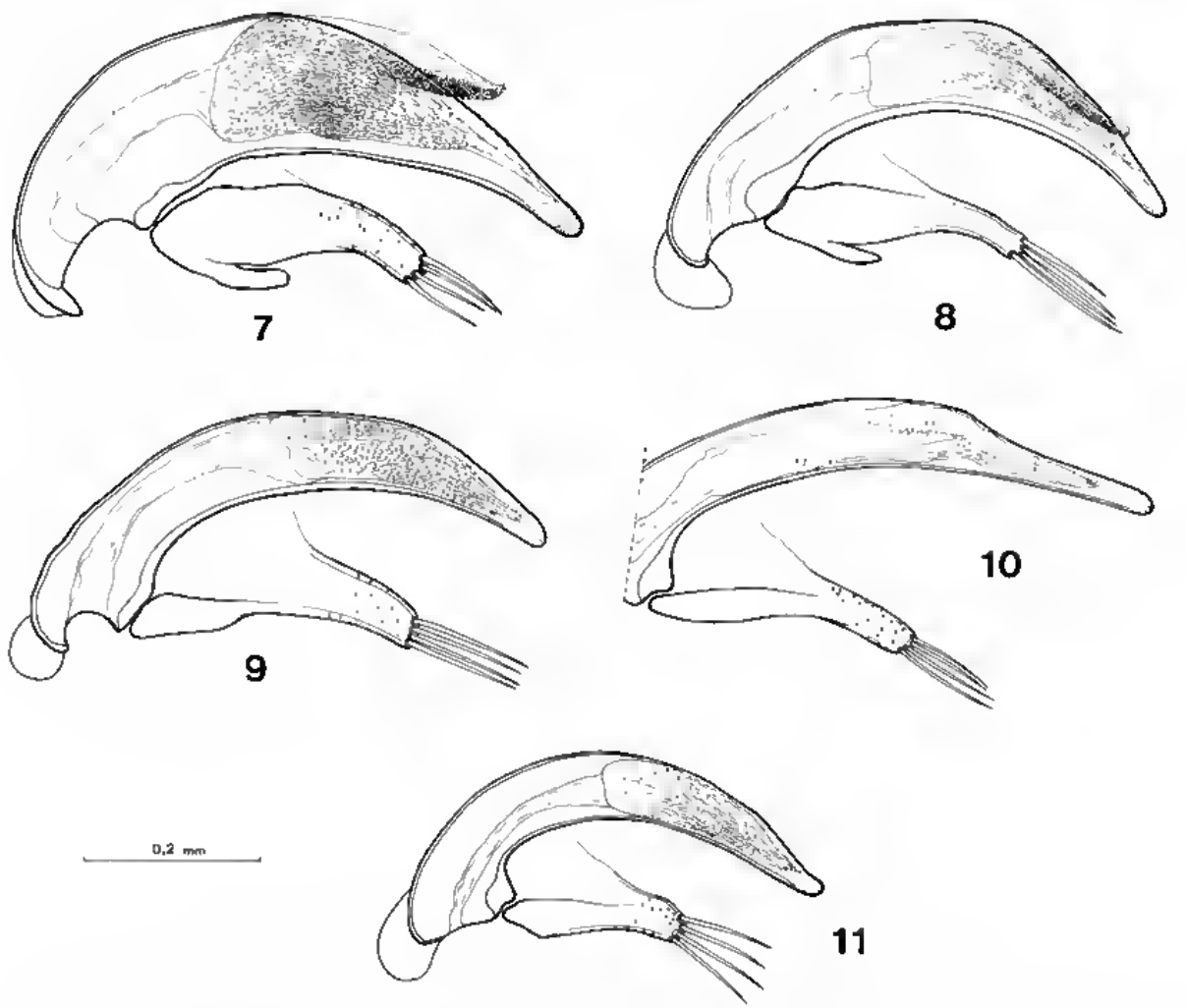

FIG. 7-11. — Édéages des mâles des espèces nouvelles, lobe médian et paramére, face latérale : 7, *Trechus simbuaensis* n. sp.; 8, *T. tamurensis* n. sp.; 9, *T. schawalleri* n. sp.; 10, *T. martensi* n. sp.; 11, *Stevensius bidulus* n. sp.

Source : MNHN, Paris

CARACTÈRES DIAGNOSTIQUES. — Espèce avant tout reconnaissable à sa taille réduite pour le genre. L'édéage caractéristique.

Cohabite avec l'espèce précédente.

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Source : MNHN, Paris

Source : MNHN, Paris

Bull. Mus. natl. Hist. nat., Paris, 4e sér., **13**, 1991,
section A, nos 3-4 : 373-422

Galatheid crustaceans of the genus *Munida* Leach, 1818, from French Polynesia.

by Enrique MACPHERSON and Michèle DE SAINT LAURENT

Abstract. — Galatheid crustaceans of the genus *Munida* collected in several localities in French Polynesia have been studied. The collection contains 14 species, all of them here described as new : *Munida amathea, M. ducoussoi, M. evarne, M. hystrix, M. lenticularis, M. longicheles, M. ocellata, M. pasithea, M. plexaura, M. polynoe, M. profunda, M. pulchra, M. rubella, and M. rubrovata.* An identification key for all of these species is provided.

Résumé. — Les espèces du genre *Munida* récoltées en Polynésie française qui font l'objet de cette étude comprennent une centaine de spécimens, répartis en 14 espèces, toutes nouvelles pour la science : *Munida amathea, M. ducoussoi, M. evarne, M. hystrix, M. lenticularis, M. longicheles, M. ocellata, M. pasithea, M. plexaura, M. polynoe, M. profunda, M. pulchra, M. rubella* and *M. rubrovata.* La grande majorité des échantillons a été récoltée au casier, l'ensemble provient de profondeurs de 100 à un peu plus de 1000 m. Cette faune diversifiée peut être séparée en plusieurs groupes, possédant chacun des formes plus ou moins affines dans l'Indo-Ouest Pacifique. Ces *Munida* sont, dans l'ensemble, très vivement colorées. Leur étude systématique est précédée par un tableau de détermination. Trois espèces, *Munida normani* Henderson, 1885, *Munida* cf. *pilosimanus* Baba, 1969 et *Munida* cf. *soelae*, Baba, 1986, appartenant à un groupe taxonomique jusqu'à présent inclus dans le genre *Munida*, mais devant être rattachées à un nouveau genre, en cours de description, ont aussi été récoltées dans les eaux polynésiennes ; elles n'ont pas été prises en considération dans ce travail.

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INTRODUCTION

The crustacean decapod fauna of French Polynesia has received some attention during recent years (i.e. BRUCE, 1989 ; PEYROT-CLAUSADE, 1989 ; GUINOT, 1991 ; CHAN and CROSNIER, 1991, ZARENKOV and KHODKINA, 1981, and references cited herein). In these papers, the description of interesting new species has pointed to our lack of knowledge and also to the peculiar decapod fauna in this area of the Pacific ocean.

No species of the genus *Munida* have been reported before from Polynesia, although some papers on *Paramunida* and other galatheids from the Central Pacific have been published (BABA, 1981 ; TITGEN, 1987). With 14 species new to scienee, the collection obtained during the radiobiologic survey carried out in French Polynesia by the Service Mixte de Contrôle

Source : MNHN, Paris

Biologique de l'Armée (SMCB) is most interesting and fills a gap in the knowledge of this poorly studied group.

Considering that about 35 true *Munida* (BABA, 1988) are known from the Indo-West Pacific region, the discovery of 14 new species in French Polynesian waters appears proportionally very large ; this however reflects the general lack of knowledge of bathyal galatheids in the whole Indo-Pacific area. A preliminary study by one of us (E.M.) shows that many undescribed species are also present in New Caledonian waters.

After the most important work of BABA on the Albatross galatheids from Philippine and Indonesian waters (1988), the study of the Polynesian material also points out the importance of several morphological characters (i.e. size and number of lateral spines on the carapace, ornamentation of the thoracic sternites, sizes of antennular and antennal spines), that can be easily applied in species identification (see also RICE and DE SAINT LAURENT, 1985 ; de SAINT LAURENT and MACPHERSON, 1988).

Through the active collaboration of J. POUPIN, who provided colour slides of many specimens, the colour pattern of most species fortunately could be included in the descriptions. In some cases, where the morphological distinction between close species presents some difficulties, the knowledge of colouration can be a great help in identification.

BABA (1988) created a new genus, *Paramunida*, to accommodate seven Indo-West Pacific species, of which five had previously been included in *Munida*. The diagnostic characters of *Paramunida* are the lack of transverse setiferous striae on the dorsal carapace, and the lack of pleopods on the first abdominal segment in males. We believe that the second character is a most important one in the taxonomy of the family Galatheidae, and that a number of species, still included in *Munida*, but sharing this character (and some others) with *Paramunida*, should also be excluded from the genus and be accommodated into a further new one. For that reason, three species collected in French Polynesia during the SMCB survey have not been included in the present publication. These species are *Munida normani* Henderson, 1885, *Munida* sp. cf. *pilosimanus* Baba, 1969 and *Munida* sp. cf. *soelae* Baba, 1986. They will be reported upon in a further paper.

The genus *Munida* is thus restricted here to species bearing two pairs of male gonopods (Pl1 and Pl2).

The types of the new species and the other material are deposited in the collections of the Muséum national d'Histoire naturelle, Paris (MNHN). Measurements given in this paper are of carapace length, excluding rostrum.

The terminology for the carapace dorsal spines and regions mainly follows ZARIQUIEY-ALVAREZ (1952), but we have named the outer orbital spine of ZARIQUIEY-ALVAREZ as the first anterolateral spine, assuming that in the genus *Munida* there is not a true orbit (as in some other genera of Galatheids). This spine can be situated at the anterolateral angle or on the frontal border, near this angle. In our descriptions, the term " overreaching " is used in the sense of reaching beyond the end or the extremity of the quoted segment of appendage.

KEY TO SPECIES OF THE GENUS *Munida* FROM FRENCH POLYNESIA

1. — Anterior half of dorsal carapace with numerous, regular spines, extending to second postcervical striae (fig.1a). Second abdominal tergite unarmed ..... *M. hystrix*

Source : MNHN, Paris

— Anterior half of carapace with at most one row of epigastric spines and one or two spines on parahepatic and branchial regions. Second abdominal tergite with or without spines..... 2

2. — Five well developed spines on lateral margins of carapace behind cervical groove..... 3
— Three or four well developed spines on lateral margins of carapace behind cervical groove.. 7

3. — One pair of epigastric spines on anterior region of carapace..... *M. profunda*
— At least two pairs of epigastric spines..... 4

4. — Eyes small, maximum corneal diameter less than 1/4 length of anterior border of carapace between anterolateral spines. Distomesial spine of basal antennular segment longer than distolateral spine ..... *M. ducoussoi*
— Eyes large, maximum corneal diameter at least 1/3 length of anterior border of carapace between anterolateral spines. Distomesial spine of basal antennular segment shorter than distolateral spine..... 5

5. — Distomesial spine of second antennal segment overreaching peduncle. Fixed finger of chelipeds with a row of spines along whole of lateral border..... *M. rubrovata*
— Distomesial spine of second antennal segment shorter than peduncle. Fixed finger of chelipeds with proximal spines only..... 6

6. — Small median depression on intestinal region, without striae or scales. Anterolateral spine slightly longer than following spine..... *M. amathea*
— No median depression on intestinal region, one wide median stria. Anterolateral spine three times longer than the following spine..... *M. rubella*

7. — Abdominal tergites unarmed..... *M. plexaura*
— Second abdominal tergite with spines..... 8

8. — Lateral parts of fifth to seventh thoracic sternites with marked carinae (fig.8)..... 9
— Lateral parts of fifth to seventh thoracic sternites without carinae (fig. 13)..... 13

9. — Distal spines of basal antennular segment subequal. One row of spines along lateral border of cheliped fixed finger. Four marginal spines on carapace behind cervical groove. *M. lenticularis*
— Distomesial spine of basal antennular segment much shorter than distolateral spine. Spines on mesial border of cheliped fixed finger, if present, limited to proximal half. Three or four marginal spines on carapace behind cervical groove..... 10

10. — Four spines on lateral margins of carapace behind cervical groove. Fixed finger of chelipeds with several spines on proximal half of dorsolateral border..... 11
— Three spines on lateral margins of carapace behind cervical groove (but see *M. longicheles* p. 409). No spine on proximal half of dorsolateral border of fixed finger of chelipeds..... 12

11. — Cornea maximum diameter less than 1/3 length of anterior border of carapace between anterolateral spines. In fresh specimens, dorsal carapace with one yellow-orange spot, circled with whitish on each antero-branchial region..... *M.ocellata*
— Cornea maximum diameter more than 1/3 length of anterior border of caparace between anterolateral spines. In fresh specimens, dorsal carapace without spots on antero-branchial regions..... *M. pulchra*

12. — Cornea maximum diameter slightly more than 1/3 length of anterior border of carapace between anterolateral spines. Propodus of second pereiopod less than twice dactylus length ..... *M. longicheles*
— Cornea maximal diameter clearly less than 1/3 length of anterior border of carapace between anterolateral spines. Propodus of second pereiopod more than twice dactylus length. *M. polynoe*

13. — Distomesial spine of basal segment of antennular peduncle longer than distolateral spine. Lateral parts of thoracic sternite 7 with some coarse granules. Frontal border of carapace strongly oblique..... *M. evarne*
— Distal spines of basal segment of antennular peduncle subequal. Lateral parts of thoracic sternites 6 and 7 with many small granules. Frontal border of carapace slightly oblique .. *M. pasithea*

Source : MNHN, Paris

1. **Munida hystrix** sp. nov.

(Fig. 1 ; pl. 1A)

MATERIAL EXAMINED. — **Tuamotu Islands**, Mururoa, stn 222, 15.05.1990, 21°51.1'S, 138°58.7'W, 100 m : 1 ♂ 14 mm (holotype, MNHN Ga 1917), 1 ♂ 13.5 mm (paratype, MNHN Ga 1918).

ETYMOLOGY. — From the Latin, *hystrix*, porcupine, in reference to the numerous spines of the anterior part of the carapace.

DIAGNOSIS. — Carapace with numerous striae, dorsally armed with numerous spines on anterior half, except in meso- and metagastric regions. Frontal margins strongly oblique. Rostrum dorsally carinated, slightly curved. Supraocular spines not reaching midlength of rostrum and end of corneas. Branchial margins with four spines. Lateral parts of last thoracic sternites without carinae. Second abdominal tergite unarmed, with a single transverse stria. Eyes large. Mesial distal spine of antennular basal segment slightly shorter than lateral. Distomesial spine of basal antennal peduncle short, not overreaching second segment. Merus of third maxilliped with three marginal spines on the flexor margin, extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Chelae with numerous rows of spines. Dactylus of walking legs about half propodus length.

DESCRIPTION (holotype)

Carapace, excluding rostrum, slightly longer than wide. Transverse ridges mostly interrupted, with short non-iridescent setae. Main transverse striae on posterior part of carapace interrupted in cardiac region. Secondary striae practically absent. Anterior half of carapace covered with numerous spines, except in meso- and metagastric regions.

Frontal margins strongly oblique, lateral margins slightly convex. First anterolateral spine short, not reaching the base of supraocular spine and situated on frontal margin between this spine and anterolateral angle ; second anterolateral spine somewhat smaller than preceding one. One or two spinules between supraocular spine and first anterolateral spine and one small spinule between first and second anterolateral spines. Branchial margin with four spines decreasing in size posteriorly.

Rostrum horizontal, slightly sinuous, half as long as remaining carapace. Supraocular spines short, not reaching to midlength of rostrum, subparallel, upwardly directed.

Fourth thoracic sternite ornamented with some short arcuate striae ; fifth to seventh sternites without marked carinae. Transverse ridges between fifth, sixth and seventh sternites obtuse, slightly granulated.

Second abdominal tergite unarmed. Second to fourth tergites with one single transverse stria, continuous on second and third, interrupted medially on fourth. Fifth tergite with one weak stria, widely interrupted medially.

Eyes large, maximum corneal diameter more than one-third the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) elongate, not overreaching corneas, less than one-quarter carapace length ; two short distal spines, mesial one slightly shorter than

Source : MNHN, Paris

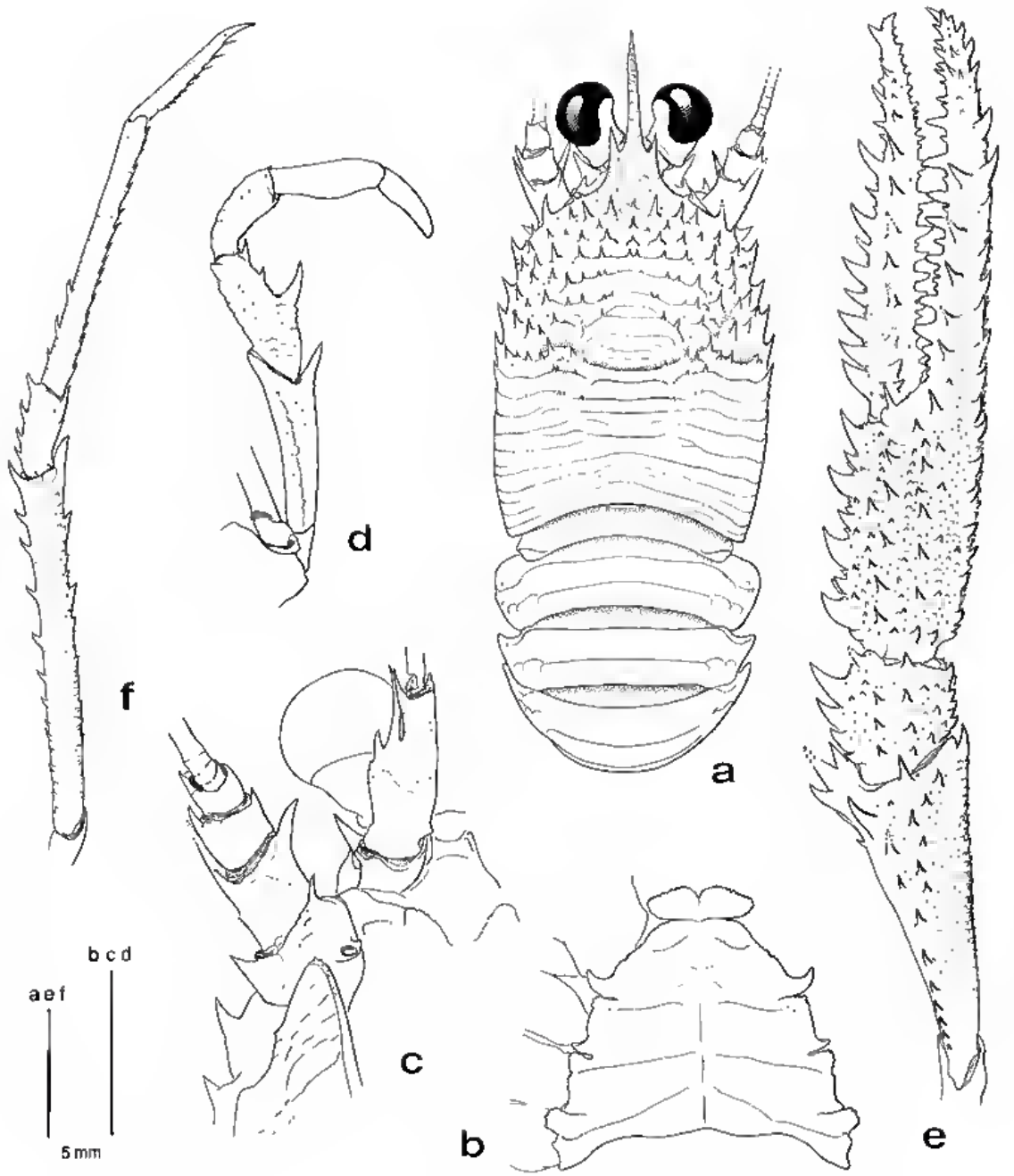


FIG. 1. — *Munida hystrix* sp. nov., holotype, male 14 mm (MHN Ga 1917) : a, carapace, dorsal view ; b, sternal plastrom ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

lateral, and two lateral spines, proximal one short, located at midlength of segment, distolateral spine long, overreaching distal spines.

First segment of antennal peduncle with short, strong distomesial and distolateral spines, shorter than second segment ; second segment with two long distal spines, lateral spine overreaching penultimate segment ; penultimate segment with two short distal spines, lateral spine longer than mesial ; last segment with one small distolateral spine.

Ischium of third maxilliped slightly more than 1.5 times length of merus, measured along extensor margin, distoventrally bearing spine. Merus with three spines on flexor margin, proximal longer than others. Extensor margin unarmed.

Chelipeds subequal. Right appendage more than 3 times as long as carapace. Merus slightly shorter than carapace, *c.* 2.5 times longer than carpus and slightly longer than palm ; palm twice as long as high and more than half finger length. Merus furnished with long, dense setae on mesial margin, armed with one mesial row of spines, some scattered spines on dorsal and ventral sides ; a projection on mesial distal margin with five strong spines of different size ; one distolateral spine. Carpus also with mesial row of strong spines, and several spines on dorsal, lateral and ventral sides. Palm with many spines and acute granules on mesial, dorsal and lateral sides ; one mesial row of spines, four of them very strong, two dorsal rows of strong spines, dorsolateral row of spines, continuing along fixed finger. Fingers distally curving, with crossing ends ; fixed finger with one dorsal row, movable finger with mesial and dorsal rows, of strong spines ; cutting edges of both fingers with teeth of different sizes. Left cheliped slightly gaping.

Walking legs slender, furnished with long, plumose setae, some of them iridescent, on dorsal margin, and with some scattered setae on lateral borders. Second pereiopods slightly less than 3 times carapace length. Merus slightly longer than carapace, 8 to 9 times as long as high, *c.* 4.5 times carpus length and 1.5 times as long as propodus ; propodus *c.* 10 times as long as high and twice dactylus length. Merus with one dorsal row of 12-14 spines increasing in size distally, ventral margin with long distal spine and with 1-2 projected scales on distal half. Carpus with one long distal spine on dorsal and ventral borders, 3-4 additional spines on dorsal margin. Propodus with ventral row of 14-17 movable spines (spiniform setae) on ventral margin and 3-4 dorsolateral proximal spines. Dactylus long, dorsal margin straight, curving distally, with ten ventral movable spinules. Third pereiopod similar to second, slightly shorter. Fourth pereiopod shorter than second and third, less spinulated ; length of merus 3/4 that of second pereiopod. Epipods absent from all pereiopods.

Colour : Ground colour whitish. Anterior part of carapace pink with reddish spots on hepatic and mesogastric areas. Transverse red band, interrupted medially, crossing posterior half of carapace. Second to fourth abdominal tergites with one transverse reddish band ; fifth and sixth tergites and telson whitish. Tip of rostrum red. Chelipeds with red bands on distal part of carpus and palm ; median red band on fingers. Walking legs with whitish and pinkish bands.

VARIATIONS. — No significant differences have been observed between holotype and paratype.

REMARKS. — The characteristic spinulation of the carapace and chelipeds of this species distinguishes it easily from the other *Munida* of French Polynesia. Its nearest relative appears to be *M. brucei* Baba, 1974 from the eastern coast of Kenya (BABA, 1974 ; 1988). The two species differ in the following aspects :

Source : MNHN, Paris

— the spines on the anterior part of the carapace are longer and more numerous in the new species than in *M. brucei* ;

— the fingers of the chelipeds are more than twice as long as the palm in *M. brucei*, they are shorter in the new species.

The colour pattern of the two species is also distinct : *Munida hystrix* has reddish spots and bands on the carapace, abdomen and chelipeds, while in *M. brucei* these spots and bands are pale or purplish and they differ in their pattern.

DISTRIBUTION. — Tuamotu Islands (Mururoa), 100 m depth.

2. **Munida profunda** sp. nov.
(Fig. 2 ; pl. 1B)

MATERIAL EXAMINED. — **Tuamotu Islands**, Fangataufa, stn 327, 24.10.1990, 22°16.7'S, 138°42.8'W, 1050 m, trap : 1 ♀ ov. 17.0 mm (holotype MNHN Ga 1997).

ETYMOLOGY. — The name *profunda* refers to the great depth at which this species occurs.

DIAGNOSIS. — Carapace distinctly rugose, dorsally armed with two epigastric spines, one anterior branchial spine on each side. Frontal margins nearly transverse. Rostrum slightly curved upwards. Supraocular spines feebly divergent, reaching midlength of rostrum and end of corneas. Branchial margins with five spines. Fifth to seventh thoracic sternites without marked lateral carinae. Second abdominal tergite with seven spines and one transverse stria. Eyes small. Distomesial spine of antennular basal segment shorter than lateral. Distal spine of basal antennal peduncle slightly overreaching second segment. Merus of third maxilliped with one ventral marginal spine and one distal acute granule, extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Dactylus of walking legs slightly more than half propodus length.

DESCRIPTION (holotype)

Carapace, excluding rostrum, slightly longer than wide. Dorsal surface with distinct striae and dense, short, non-iridescent setae. Transverse ridges mostly interrupted. Main transverse striae on posterior part of carapace interrupted in the cardiac region. Secondary striae almost absent. Hepatic and anterior branchial regions scarcely squamous. Gastric region with two epigastric spines, just behind supraocular spines. Each anterior branchial region with one spine.

Frontal margins transverse, lateral margins slightly convex. Anterolateral spine well developed, situated at anterolateral angle, overreaching level of sinus between rostrum and supraocular spine. Second marginal spine before cervical groove somewhat smaller than preceding one. Branchial margin with five spines, first larger.

Rostrum half as long as remaining carapace, slightly curved upwards. Supraocular spines reaching to midlength of rostrum, and end of corneas, feebly divergent and upwardly directed.

Fourth thoracic sternite with some short arcuate striae ; fifth to seventh sternites glabrous. Transverse ridges between fifth, sixth and seventh sternites obtuse, slightly granulated.

Source : MNHN, Paris

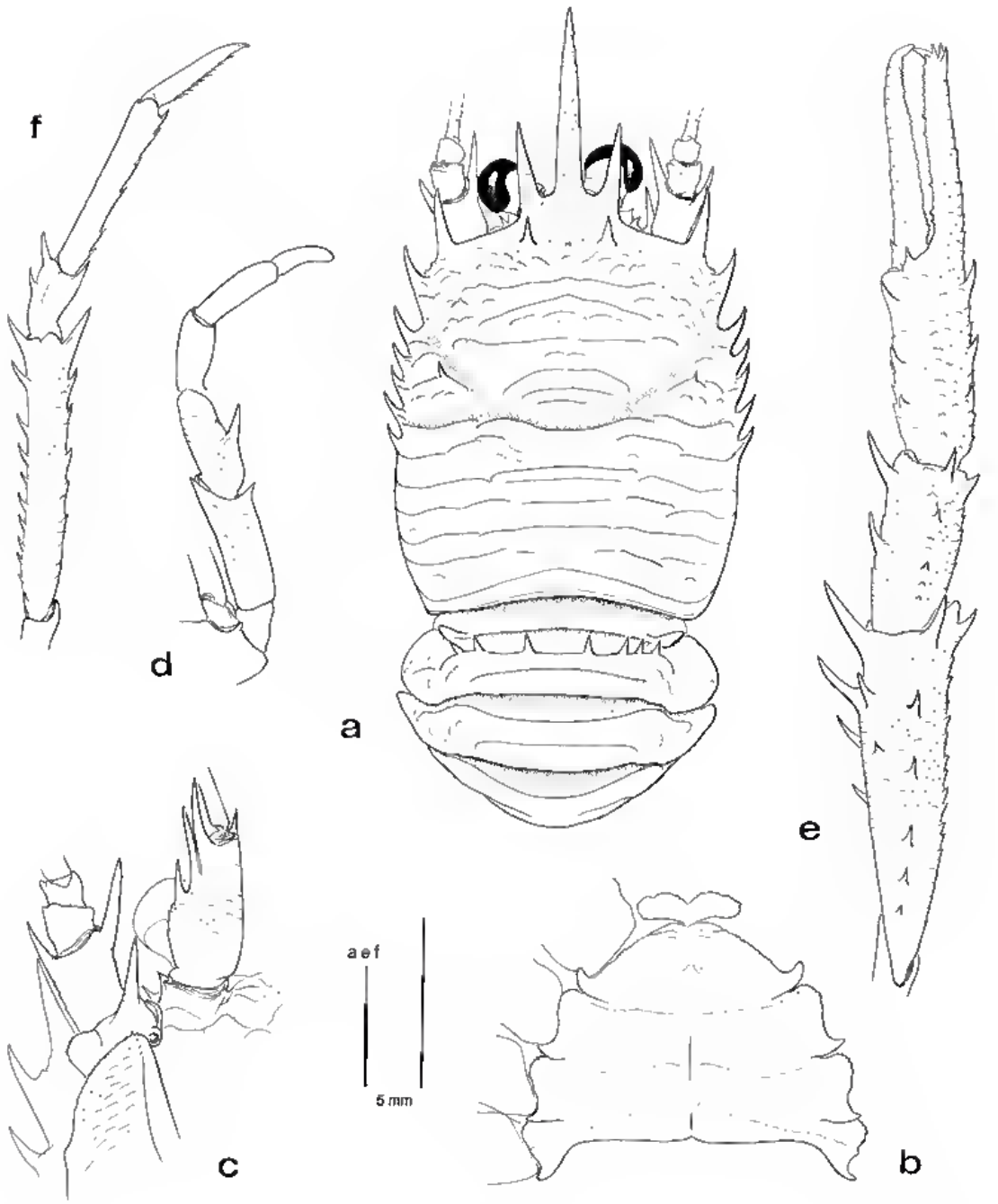


FIG. 2. — *Munida profunda* sp. nov., holotype, female 17 mm (MNHN Ga 1997) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

Second abdominal tergite with one row of seven spines on anterior border. Second and third tergites unarmed, with one strong continuous transverse stria ; fourth and fifth also with one stria, less conspicuous, and widely interrupted medially.

Eyes small, maximum corneal diameter less than one-quarter the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) elongate, *c.* one quarter carapace length., overreaching corneas ; distomesial spine clearly shorter than distolateral ; two spines on lateral border, proximal spine short, located at midlength of segment, second lateral long, not overreaching distolateral spine.

First segment of antennal peduncle with one strong distomesial spine, about as long as second segment ; second segment with two long distal spines, mesial spine clearly longer than lateral, overreaching antennal peduncle ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus, measured along extensor margin, distoventrally bearing small spine. Flexor margin of merus bearing one median well developed spine, and one distal acute granule ; extensor margin without spines.

Chelipeds feebly squamous, subequal, with long plumose setae more dense on mesial borders of articles. Right cheliped *c.* 2.5 times as long as carapace. Merus slightly shorter than carapace, *c.* twice as long as carpus and 1.5 times longer than palm ; palm 2.5 times as long as high and slightly shorter than fingers. Merus armed with four prominent distal spines, mesial spine strongest, not reaching middle of carpus. Carpus with one dorsal row of spines and scattered spines on mesial and ventral sides. Palm with one mesial and one dorsolateral row of spines, not continuing along fixed finger. Fingers distally curving and crossing, ending in sharp point ; dactylus with one small proximomesial spine, fixed fingers with 2-3 distal spines ; cutting edges with small teeth of unequal sizes.

Walking legs slender, furnished with long, plumose setae on dorsal margin and with some short setae on lateral borders. Second pereiopod twice carapace length ; merus slightly shorter than carapace, 7 times as long as high, *c.* 4 times carpus length and 1.5 times as long as propodus ; propodus *c.* 5 times as long as high and 1.5 times dactylus length. Merus with dorsal row of 10-11 spines, increasing in size distally, ventral border with one long distal spine and three projecting scales on distal half. Carpus with two dorsal and one ventrodistal spines. Propodus with six movable spines on ventral margin. Dactylus long, dorsal margin straight, slightly curving distally, with 9-10 movable spinules along ventral margin. Third pereiopod similar to second. Fourth pereiopod shorter than second and third pereiopods and less spinulated. Merus of fourth pereiopod half length of second pereiopod. Epipods absent from all pereiopods.

Colour : Ground colour of carapace and anterior abdominal segments pinkish. Posterior abdominal segments and telson white. Striae on carapace and second abdominal segment reddish. Distal part of rostrum, of supraocular spines, and all carapace spines red. Chelipeds pink, the spines and distal half of fingers red. Walking legs pink, distal spines of merus and carpus and distal half of dactylus reddish.

REMARKS. — *Munida profunda* resembles *M. andamanica* Alcock, 1894, a widespread species throughout the Indo-West Pacific. BABA (*pers. commun.*) believes that several species have been confused under this name. After considering the descriptions and illustrations of ALCOCK (1894 ; 1901) and of ALCOCK and ANDERSON (1895), our new species differs from *M. andamanica*

Source : MNHN, Paris

in that the eyes are clearly smaller and the number of epigastric spines are reduced to one pair. Moreover, the distomesial spine of the basal antennular segment is much smaller than the distolateral in *profunda*, whereas these spines are subequal in *andamanica*.

Considering the size of the eyes, *M. profunda* is close to *M. remota* Baba, 1990, from Madagascar. The two species differ however by the number of epigastric spines, more numerous in *remota*, and by the relative sizes of the distal spines of the second antennal segment ; but the most important character to separate them is perhaps the presence of two spines on the flexor margin of the merus of the third maxilliped in *remota*, instead of one in *profunda*.

DISTRIBUTION. — Tuamotu Islands (Fangataufa), 1050 m depth.

3. **Munida ducoussoi** sp. nov.
(Fig. 3)

MATERIAL EXAMINED. — **Tuamotu Islands**, Makemo, stn 308, 07.10.1990, 16°34.5'S, 143°39.9'W, 280 m, trap : 2 ♂ 13 and 18.5 mm (MNHN Ga 1995). — **Tubuai Islands** (Iles Australes), Raivavae, 01.03.1989, 23°50'S, 147°43.4'W, 550 m, trap : 1 ♂ 18.5 mm (holotype MNHN Ga 1893).

TYPES. — One male (18.5 mm) from Raivavae (Tubuai Islands) has been selected as holotype (MNHN Ga 1893). The other specimens are paratypes.

ETYMOLOGY. — It is a pleasure to dedicate this species to R. DUCOUSSO, head of the scientific program of the SMCB, for his support of this work.

DIAGNOSIS. — Carapace with numerous striae, dorsally armed with 11 epigastric spines ; parahepatic, hepatic, anterior branchial and postcervical spines present. Frontal margins somewhat oblique. Rostrum slightly curved. Supraocular spines reaching midlength of rostrum and end of corneas. Branchial margins with five spines. Fifth to seventh thoracic sternites without lateral carinae, lateral parts of seventh sternite with numerous coarse granules. Second abdominal tergite with four pairs of spines and three transverse striae. Eyes small. Distomesial spine of antennular basal segment longer than distolateral. Distal spine of basal antennal peduncle overreaching penultimate segment. Merus of third maxilliped with three ventral marginal spines, dorsal margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Chelipeds fingers armed with spines along dorsolateral and mesial margins respectively. Dactylus of walking legs about half propodus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted. Main striae on posterior part of carapace interrupted in cardiac region. Secondary striae present. Gastric region with one row of 11 epigastric spines, largest pair just behind supraocular spines. One hepatic, parahepatic, branchial anterior and postcervical spine on each side.

Frontal margins somewhat oblique. Lateral margins slightly convex. Anterolateral spine well developed, situated at antero-lateral angle, overreaching the level of sinus between rostrum

Source : MNHN, Paris

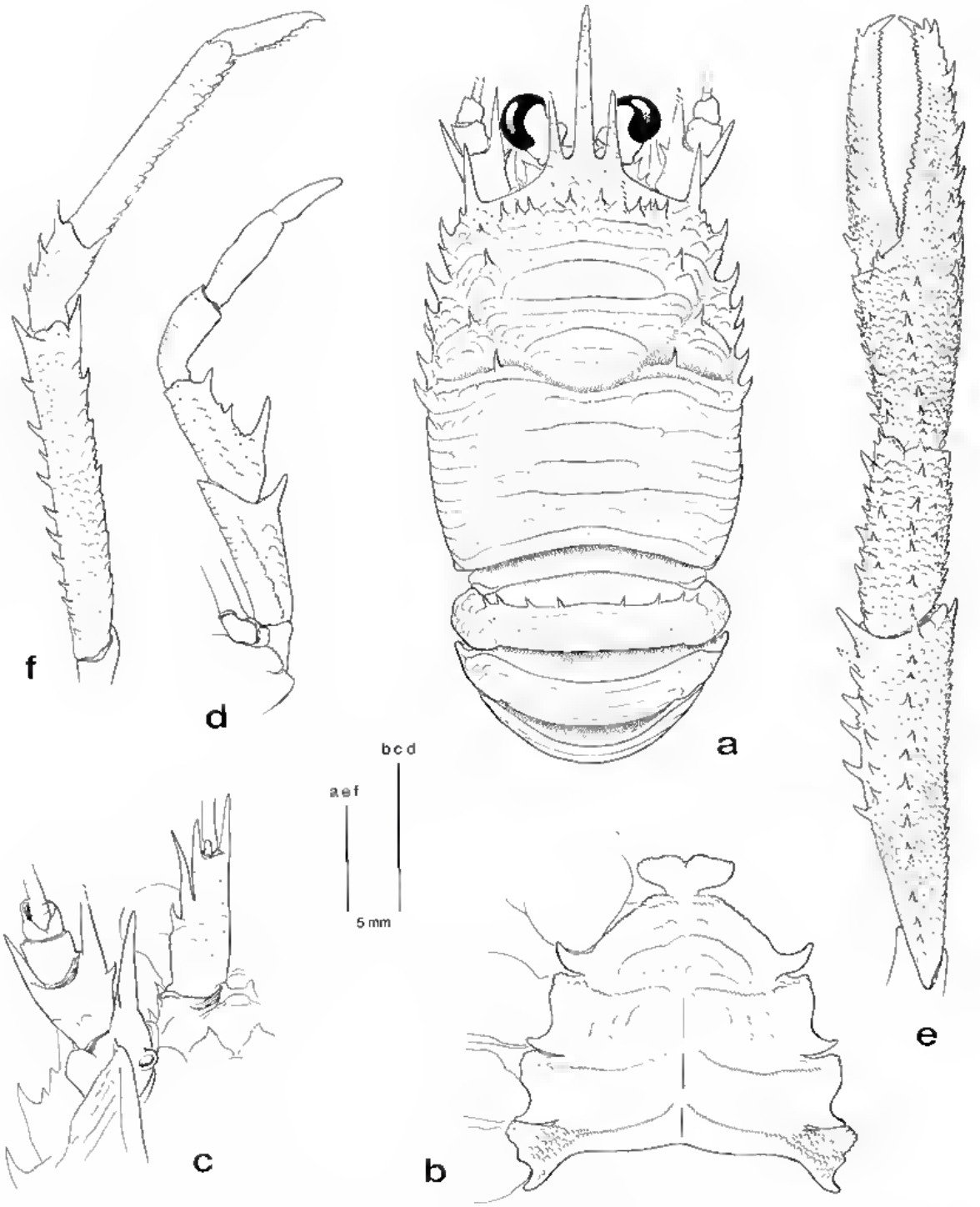


FIG. 3. — *Munida ducoussoi* sp. nov., holotype, male 18.5 mm (MNHN Ga 1893) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennule and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

and supraocular spine. Second marginal spine before cervical groove somewhat smaller than preceding one. Both of these spines with one basal spinule. Branchial margins with five spines of about similar size.

Rostrum horizontal, feebly sinuous, half as long as remaining carapace. Supraocular spines more slender than rostrum, reaching to its midlength and to end of corneas, subparallel and slightly upwardly directed.

Fourth thoracic sternite with some short but very conspicuous arcuate striae ; fifth sternite with several longitudinal oblique striae ; lateral parts of seventh sternite with numerous coarse granules. Transverse ridges between fifth, sixth and seventh sternites obtuse, slightly granulated.

Second abdominal tergite with one row of four pairs of spines on anterior border. Second to fourth abdominal tergites each with three transverse striae : the two anterior striae are continuous ; the third stria, less conspicuous, is interrupted medially on the fourth segment only.

Eyes small, maximum corneal diameter less than one-quarter the distance between bases of anterolateral spines.

Basal segment of antennule elongate, less (distal spines excluded) than one quarter carapace length, clearly overreaching cornea ; with two distal spines, distomesial spine distinctly longer than distolateral ; and two spines on lateral margin, proximal short, located at midlength of segment, distal long, not overreaching distomesial spine.

First segment of antennal peduncle with one strong distomesial spine, overreaching penultimate segment ; second segment with two long distal spines, mesial longer than lateral, overreaching antennal peduncle ; one additional small spinule on mesial margin ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus, measured along extensor margin ; distoventrally bearing spine. Merus bearing three well developed spines on flexor margin, proximal spine longer than others. Extensor margin unarmed.

Chelipeds squamous, subequal, furnished with iridescent setae more dense on mesial borders of articles. Right cheliped *c.* 2.5 times as long as carapace. Merus slightly shorter than carapace, *c.* twice as long as carpus and palm ; palm *c.* 1.5 times as long as high and slightly shorter than fingers. Merus armed with four rows of spines respectively on mesial, dorsal and ventral borders and with one distal spine on lateral margin. Carpus with one dorsal row of spines and several spines scattered on dorsal, mesial and ventral sides. Palm with two mesial rows of spines, one dorsal row of small spines and one row of dorsolateral spines continuing along fixed finger, reaching tip. Fingers distally curving and crossing, ending in a sharp point ; movable finger with one row of spines along mesial border, reaching tip ; cutting edges with small teeth of various sizes.

Walking legs slender, furnished with long, plumose, iridescent setae on dorsal margin, and with short setae on lateral borders. Second pereiopod twice carapace length. Merus slightly shorter than carapace length, almost 7 times as long as high, *c.* 3.5 times carpus length and 1.5 time as long as propodus ; propodus *c.* 6.5 times as long as high and twice dactylus length. Merus with one dorsal row of 12 spines increasing in size distally and one long distal spine on ventral margin, with one additional spine on distal half. Carpus with long dorsodistal and ventrodistal spines, with three additional spines on dorsal margin. Propodus with one ventral row of 14-15 spiniform setae. Dactylus long, dorsal margin straight, feebly curving distally,

Source : MNHN, Paris

with 7-8 ventral spiniform setae. Third pereiopod similar to second. Fourth pereiopod shorter than second and third, less spinulated. Merus of fourth pereiopod half as long as that of second pereiopod. Epipods absent from all pereiopods.

REMARKS. — *Munida ducoussoi* resembles *Munida rubrovata* sp. nov. in the spinulation of the lateral margins of the carapace and of the abdominal segments. The two species differ mainly in that, in *M. ducoussoi* :

— the eyes are much narrower : the maximum corneal diameter is *c.* one-quarter the length of the anterior border of the carapace, between the bases of the anterolateral spines ; in *M. rubrovata*, this ratio is more than one-third ;

— the distomesial spine of the basal segment of the antennule is longer than the distolateral spine ; in *M. rubrovata* the mesial spine is shorter than the lateral spine ;

— the distal spine of the first antennal segment is very long, overreaching the penultimate segment ; in *M. rubrovata* this spine is shorter, only reaching the end of the second segment ;

— the dactyli of the chelipeds have a mesial row of spines, reaching the tip of the finger ; in *M. rubrovata* there is only one proximal spine.

The best character to distinguish the two species is the sternum ornamentation, richly furnished with arcuate striae and with numerous granules on lateral parts of seventh sternites in *ducoussoi*, almost smooth in *rubrovata*.

DISTRIBUTION. — Tuamotu (Makemo) and Tubuai (Raivavae) Islands. Depths between 280 and 550 m.

4. **Munida rubrovata** sp. nov.
(Fig. 4 ; pl. 1C)

MATERIAL EXAMINED. — **Society Islands**, Moorea, stn 258, 18.06.1990, 17°31.9'S, 149°35.3'W, 430 m, trap : 1 ♀ ov.12.5 mm (MNHN Ga 1901). — **Tuamotu Islands**, Fangataufa, stn 323, 23.10.1990, 22°13.2'S, 138°42.7'W, 500 m, trap, 2 ♂ 12 mm, 1 ♀ ov.13 mm (MNHN Ga 1992) ; Mururoa, 1984, without other explanation (n° 075159 A & 075172 A) : 1 ♂ 11.5, 1 ♀ ov. 11.5 mm (MNHN Ga 1902). — **Tubuai Islands**, Raivavae, 01.03.1989, 23°51.4'S, 147°44.5'W, 300 m, trap : 1 ♂ 16.5 mm (MNHN Ga 1896) ; Rimitara, 03.09.1988, 500-700 m, trap : 1 ♂ 14.5 mm (holotype MNHN Ga 1899), 5 ♂ 9.5 to 14.5 mm (MNHN Ga 1900).

TYPES. — One male (14.5 mm) from Rimatara (Tubuai) has been selected as holotype (MNHN Ga 1899). The other specimens are paratypes.

ETYMOLOGY. — From the Latin *rubra*, red, *ova*, eggs, in reference to the deep red colouration of the eggs.

DIAGNOSIS. — Carapace dorsally armed with four pairs of epigastric spines ; parahepatic, anterior branchial and postcervical spines present. Frontal margins nearly transverse. Rostrum almost horizontal. Supraocular spines not reaching to midlength of rostrum and end of corneas. Branchial margins with five spines. Fifth to seventh thoracic sternites without lateral carinae, lateral parts of seventh stemite smooth.

Source : MNHN, Paris

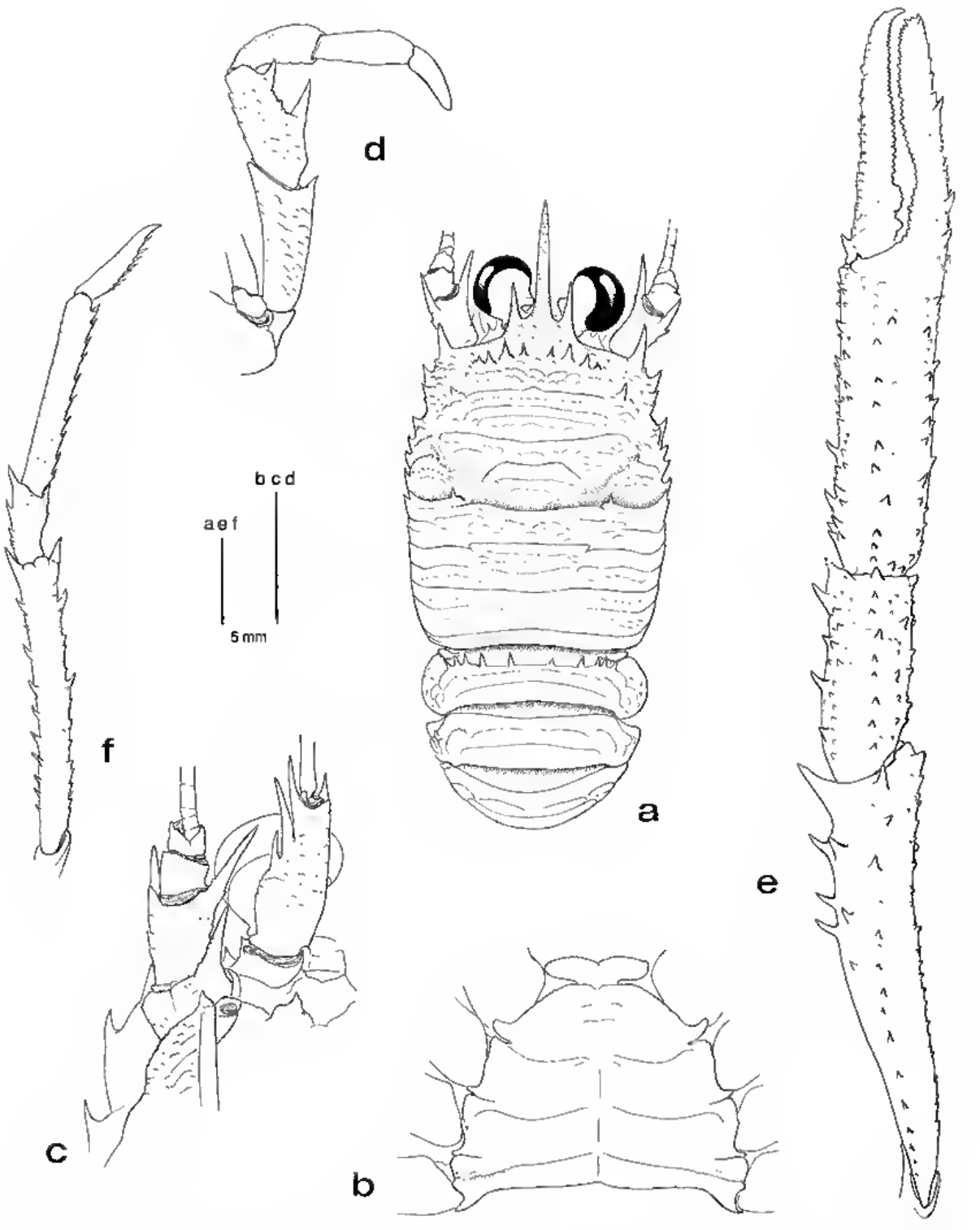


FIG. 4. — *Munida rubrovata* sp. nov. : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view. a, e, f : holotype, male 14 5 mm (MNHN Ga 1899) ; b, c, d : paratype, female 12.5 mm (MNHN Ga 1901).

Source : MNHN, Paris

Second abdominal tergite with five pairs of spines and two transverse striae. Eyes large. Distomesial spine of antennular basal segment shorter than distolateral. Distal spine on basal segment of antennal peduncle not overreaching second segment. Distomesial spine of second segment overreaching peduncle. Merus of third maxilliped with two marginal spines on flexor margin, extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Chelipeds with fixed fingers armed with spines all along dorsolateral margin. Dactylus of walking legs about half propodus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with short, not iridescent setae. Main striae on posterior part of carapace interrupted in cardiac region. Secondary striae almost absent, some small scales between main striae. Gastric region with one row of four pairs of epigastric spines, largest pair just behind supraocular spines. One parahepatic, one branchial anterior and one postcervical spine on each side.

Frontal margins nearly transverse, lateral margins slightly convex. Anterolateral spine well developed, situated at anterolateral angle, not overreaching sinus between rostrum and supraocular spine. Second marginal spine before cervical groove somewhat smaller than preceding one. Both spines bearing one basal spinule. Branchial margins with five spines, decreasing in size posteriorly.

Rostrum almost horizontal, slightly curved upwards, half as long as remaining carapace. Supraocular spines not reaching midlength of rostrum and end of corneas, subparallel and upwardly directed.

Fourth thoracic sternite with a few very short, oblique, arcuate striae ; fifth to seventh sternites smooth. Transverse ridges between fifth, sixth and seventh sternites obtuse, very slightly granulated.

Second abdominal tergite with one row of five pairs of spines on anterior border. Second to fourth abdominal tergites each with two transverse striae, anterior stria weak, interrupted medially, second stria strong, continuous. Fifth segment with two continuous striae.

Eyes large, maximum corneal diameter more than 1/3 the distance between bases of anterolateral spines.

Basal segment of antennule elongate, *c.* 1/3 carapace length (distal spines excluded), slightly overreaching corneas, with two long distal spines, mesial one shorter than distolateral ; and two lateral spines, proximal short, located at middle of segment, distal long, not overreaching distolateral spine.

First segment of antennal peduncle with one strong distomesial spine, not overreaching second segment ; second segment with two long distal spines, mesial longer than lateral, clearly overreaching antennal peduncle ; one additional spinule at middle of mesial margin (left side only) ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus, distoventrally bearing spine. Merus with two well developed spines on flexor margin, distal smaller ; extensor margin unarmed.

Chelipeds moderately squamous, subequal, with numerous short setae, more dense on mesial borders of articles. Right cheliped three times as long as carapace ; merus *c.* 1.5 times longer than carapace, twice longer than carpus and slightly more than 1.5 times longer than palm ; palm *c.* 1.5 times longer than carpus, more than twice as long as high and slightly

Source : MNHN, Paris

shorter than fingers. Merus armed with four rows of spines. Carpus with several spines scattered on dorsal, mesial and ventral sides. Palm with several spines scattered on mesial and dorsal sides and with one row of dorsolateral spines continuing along fixed finger and reaching tip. Fingers distally curving and crossing, ending in sharp point ; one proximal spine on mesial margin of dactylus ; cutting edges with small teeth of various sizes.

Walking legs elongate, furnished with long, plumose setae (some iridescent), on dorsal margin, and with short, dense setae on lateral borders. Second pereiopod twice as long as carapace length. Merus of second pereiopod slightly shorter than carapace length, 8 times longer than high, four times carpus length and *c.* 1.5 times as long as propodus ; propodus *c.* 7 times as long as high and slightly more than 1.5 times dactylus length. Merus with one dorsal row of 11 spines increasing in size distally, one long distal spine on ventral edge and 2-3 projected scales on distal half. Carpus with long dorsodistal and ventrodistal spines and three additional spines on dorsal margin. Propodus with one ventral row of 10-12 spiniform setae. Dactylus with dorsal margin slightly convex on proximal half, feebly curving distally, with eight ventral spiniform setae. Third pereiopod similar to second, but shorter ; fourth shorter than second and third, less spinulated. Merus of fourth pereiopod half that of second pereiopod. Epipods absent from all pereiopods.

Colour : Totally but unevenly reddish ; transverse red bands on gastric, cardiac and antero-branchial regions. Striae on carapace and abdomen tinged with red. Sixth abdominal segment and telson pinkish. Chelipeds and walking legs with alternate white and red bands.

Variations. — No significant variations in the main characters have been observed between the specimens examined. However, as in most species of the genus *Munida* and in other decapods, the size and shape of the chelipeds change with sex and carapace length. The chelipeds in the males examined are *c.* 3 times the carapace length, and the merus is longer than the carapace ; in the females, the chelipeds are less than 3 times the carapace length, and the merus is only as long as the carapace.

Remarks. — *Munida rubrovata* is closely related to *M. heteracantha* Ortmann, 1892. A comparison with the lectotype of *M. heteracantha* from Japan (Sagami Bay, ovigerous female of 7.3 mm, Strasbourg Museum) showed that they can be easily distinguished by the following characters :

— the new species has the lateral parts of the seventh sternite smooth, except for a few granules ; *M. heteracantha* has numerous granules on the lateral parts of the seventh sternite ;

— the distal spines of the basal segment of the antennular peduncle are subequal in *M. heteracantha*, whereas the mesial spine is shorter than the lateral in the new species ;

— the distal spine of the first antennal segment is very long in *M. heteracantha*, overreaching the antennal peduncle ; this spine does not overreach the second segment in *M. rubrovata* ;

— the dactylus of the walking legs have one row of spinules along the ventral margin in the new species, in *M. heteracantha* the distal half of the ventral border is unarmed.

Munida rubrovata is also close to *M. amathea* sp. nov., however both are easily distinguishable by several characters (see remarks for *M. amathea*).

Source : MNHN, Paris

Size. — The males ranged between 9.5 and 16.5 mm, females (ovigerous) between 11.5 and 13 mm.

Distribution. — Society Islands (Moorea), Tuamotu Islands (Fangataufa, Mururoa) and Tubuai Islands (Raivavae), between 300 and 700 m.

5. **Munida amathea** sp. nov.
(Fig. 5)

Material examined. — **Tuamotu Islands**, Fangataufa, 22.11.1988, 22°15'S, 138°47.3'W, 600-800 m, trap : 1 ♂ 21 mm (holotype MNHN Ga 1868), 8 ♂ 20.5 to 23.5 mm, 3 ♀ 17.5 to 18.5 mm, 1 ♀ ov. 18.5 mm (MNHN Ga 1869) ; 21.02.1989, 22°12.9'S, 138°47.3'W, 700 m, trap : 10 ♂ 16 to 24.5 mm, 4 ♀ 13 to 21.5 mm (MNHN Ga 1898) ; Gambier, stn 312, 11.10.1990, 23°04'3S, 135°02, 1'W, 740 m, trap : 3 ♂ 22 to 25 mm, 3 ♀ ov.15 to 22 mm (MNHN Ga 1989) ; Makemo, 12.11.1988, 16°37'S, 143°32'W, 650-750 m, trap : 6 ♂ 17 to 22 mm (MNHN Ga 1867) ; Marutea Sud, 20.11.1989, 21°34'S, 135°36'W, 690 m, trap : 4 ♂ 18 to 22.5 mm (MNHN Ga 1897) ; Mururoa, 28.06.1988, 560-600 m, trap : 2 ♂ 20.5 and 22 mm (MNHN Ga 1870). — **Tubuai Islands** (Iles Australes), Rapa, 04.03.1989, 27°35.5'S, 144°15.8'W, 640-670 m, trap : 2 ♂ 13.5 mm, 1 ♀ 12.5 mm (MNHN Ga 1894) ; Maria, stn 354, 08.12.1990, 21°47.8'S, 154°43.6'W, 710 m, trap : 10 ♂ 14 to 26 mm, 5 ♀ ov. 17 to 21 mm (MNHN, Ga 2027).

Types. — One male (21 mm) from the Tuamotu Islands (Fangataufa) has been selected as holotype (MNHN Ga 1868). The other specimens are paratypes.

Etymology. — The name refers to one of the Nereids of Greek mythology (Amathea).

Diagnosis. — Carapace dorsally armed with 5-6 pairs of epigastric spines ; parahepatic, hepatic, anterior branchial and postcervical spines present in most specimens. Short transverse median depression on intestinal region. Frontal margins almost transverse. Rostrum slightly curved. Supraocular spines reaching midlength of rostrum and not end of corneas. Anterolateral spine slightly longer thao following spine. Branchial margins with five spines. Fifth to seventh thoracic sternites without lateral carinae. Second abdominal tergite with four pairs of spines and one transverse stria. Eyes large. Distomesial spine of antennular basal segment shorter than distolateral. Distal spine of basal antennal peduncle not overreaching the third segment. Distomesial spine of second antennal segment shorter than peduncle. Merus of third maxilliped with two marginal spines on flexor margin, extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Fixed finger of chelipeds armed with proximal spines. Dactylus of walking legs *c.* half propodus length.

Description (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with short, not iridescent setae. Main striae on posterior part of carapace interrupted in cardiac region. Secondary striae almost absent in branchial areas, only some scales between main striae. Small depression without striae or scales on intestinal region. Gastric region with one row of six pairs of epigastric spines, pair just behind supraocular spines being largest. Each hepatic region with one small spine near anterolateral angle. One parahepatic spine, one branchial anterior and one postcervical spine on each side.

Source : MNHN, Paris

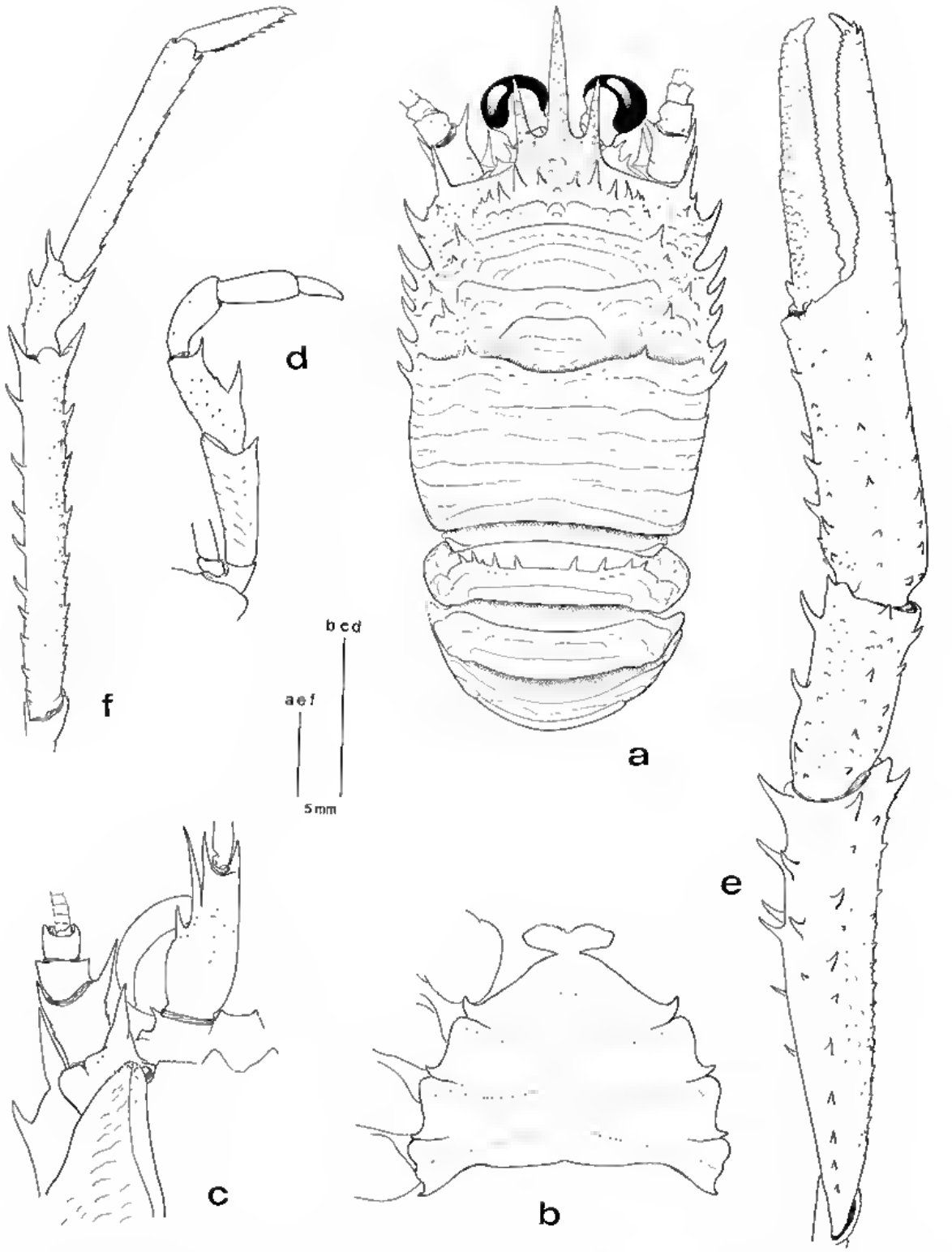


FIG. 5. — *Munida amathea* sp. nov. : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e right cheliped, dorsal view ; f, right second pereiopod, lateral view. a, e, f : holotype, male 21 mm (MNHN Ga 1868) ; b, c, d : paratype, male 13.5 mm (MNHN Ga 1894).

Source : MNHN, Paris

Frontal margins nearly transverse. Lateral margins slightly convex. Anterolateral spine well developed, situated at anterolateral angle, almost reaching to the level of sinus between rostrum and supraocular spine. Second marginal spine before cervical groove slightly smaller than preceding one. Both spines with one basal spinule. Branchial margins with five spines decreasing in size posteriorly.

Rostrum slightly sinuous, horizontal, about half as long as remaining carapace. Supraocular spines reaching midlength of rostrum and nearly to end of corneas, slightly divergent and upwardly directed.

Fourth thoracic sternite with some very small arcuate striae ; fifth to seventh sternites smooth. Transverse ridges between fifth, sixth and seventh sternites obtuse and granulated.

Second abdominal tergite with one row of four pairs of spines on anterior border. Second to fourth abdominal tergites each with one transverse continuous stria. Third and fourth segments each with one additional weak stria, situated anterior to main one and interrupted medially. Fifth segment with two uninterrupted striae.

Eyes large, maximum corneal diameter *c.* 1/3 the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) elongate, one-quarter carapace length, overreaching corneas, with two distal spines, distomesial spine shorter than distolateral spine ; and two lateral spines, proximal one short, located at midlength of segment, distal one long, overreaching distolateral spine.

First segment of antennal peduncle with strong distomesial spine, slightly overreaching second segment ; second segment with two long distal spines, mesial longer than lateral, overreaching penultimate segment although not overreaching antennal peduncle ; penultimate segment unarmed.

Ischium of third maxilliped 1.5 times length of merus, distoventrally bearing spine. Merus bearing two well developed ventral spines on flexor margin, distal smaller ; extensor margin unarmed.

Chelipeds squamous, subequal, fingers slightly gaping, with numerous short setae, more dense on mesial borders of articles. Right cheliped nearly 4 times as long as carapace ; merus slightly longer than carapace, twice as long as carpus and *c.* 1.5 times longer than palm ; palm twice as long as high and nearly as long as fingers. Merus armed with four rows of spines. Carpus with several dorsal spines and some scattered spines on mesial and ventral sides. Palm with several spines scattered on mesial and dorsal sides and one dorsolateral row not extending along fixed finger. Movable finger with one mesial spine near its base. Fixed finger with one spine on proximal half. Fingers distally curving and crossing, fixed finger ending in a sharp point, with two distal spines ; cutting edges with small teeth of various sizes.

Walking legs slender, furnished with long, plumose, not iridescent setae on dorsal margin and short, dense, setae on lateral borders. Second pereiopod *c.* twice carapace length. Merus slightly shorter than carapace length, *c.* 9 times as long as high, slightly more than 3.5 times carpus length and 1.5 times as long as propodus ; propodus 7.5 times as long as high and *c.* twice dactylus length. Merus with dorsal row of 10-11 spines, increasing in size distally, and with five spines on distal half of ventral margin, both distal spines prominent. Carpus with long distal spine on dorsal and ventral borders, one additional spine on dorsal margin. Propodus with ventral row of 11-12 spiniform setae. Dactylus with dorsal margin slightly convex on proximal half, feebly curving distally, with 11 spiniform setae along ventral margin. Third

Source : MNHN, Paris

pereiopod similar to second. Fourth pereiopod shorter than second and third, less spinulated. Merus of fourth pereiopod one-half times length of second pereiopod. Epipods absent from all pereiopods.

VARIATIONS. — The length of the supraocular spines is somewhat variable. In some specimens, as in the holotype, these spines reach the midlength of the rostrum, but not the end of the corneas. The number of epigastric spines is usually constant, although in several specimens only five pairs are present. The hepatic spine is absent in several individuals. The other important specific characters remain constant. The chelipeds in the females examined are slightly more than twice the length of the carapace, the merus being as long as the carapace, or slightly less ; in males the length of the chelipeds is 3-4 times that of the carapace and the merus is always longer. The proximal spine on the lateral border of the fixed finger may be absent.

REMARKS. — *Munida amathea* is close to *M. rubrovata* and to *M. rubella* spp. nov. A comparison of the three species shows that they differ in several constant characters. The differences between *Munida amathea* and *M. rubrovata* are :

— the fixed finger of the chelipeds has a row of dorsolateral spines, extending on its whole length in *M. rubrovata* ; whereas in *M. amathea*, only one proximal spine is present on this margin ;

— the distomesial spine of the second antennal segment is long, always overreaching the antennal peduncle in *M. rubrovata* ; the same spine is short and does not overreach the peduncle in *M. amathea* ;

— there is only one stria on the second abdominal segment in *M. amathea*, but two in *M. rubrovata*.

Munida amathea is also close to *M. rubella* sp. nov., but they differ in several characters (see remarks under that species).

SIZE. — The males examined ranged between 13.5 and 25 mm, the females between 12.5 and 22 mm. Females are ovigerous from 18.5 mm.

DISTRIBUTION. — Tuamotu Islands (Fangataufa, Makemo, Marutea South, Mururoa, Gambier) and Tubuai Islands (Maria) ; depths between 300 and 500-800 m.

6. **Munida rubella** sp. nov.
(Fig. 6 ; pl. ID)

MATERIAL EXAMINED. — **Society Islands**, Tahiti/Vairao, 10.1978 (without position), trap : 1 ♀ 21 mm (MNHN Ga 1698). — **Tuamotu Islands**, Fangataufa, 21.02.1989, 22°12.9'S, 138°47.3'W, 700 m, trap : 1 ♂ 17 mm (MNHN Ga 1993) ; stn 323, 23.10.1990, 22°13.2'S, 138°42.7'W, 500 m, trap : 1 ♂ 18 mm, 1 ov. ♀ 20 mm, 1 ♀ 12.5 mm (MNHN Ga 1992) ; stn 326, 24.10.1990, 22°16.4'S, 138°43.8'W, 510 m, trap : 1

Source : MNHN, Paris

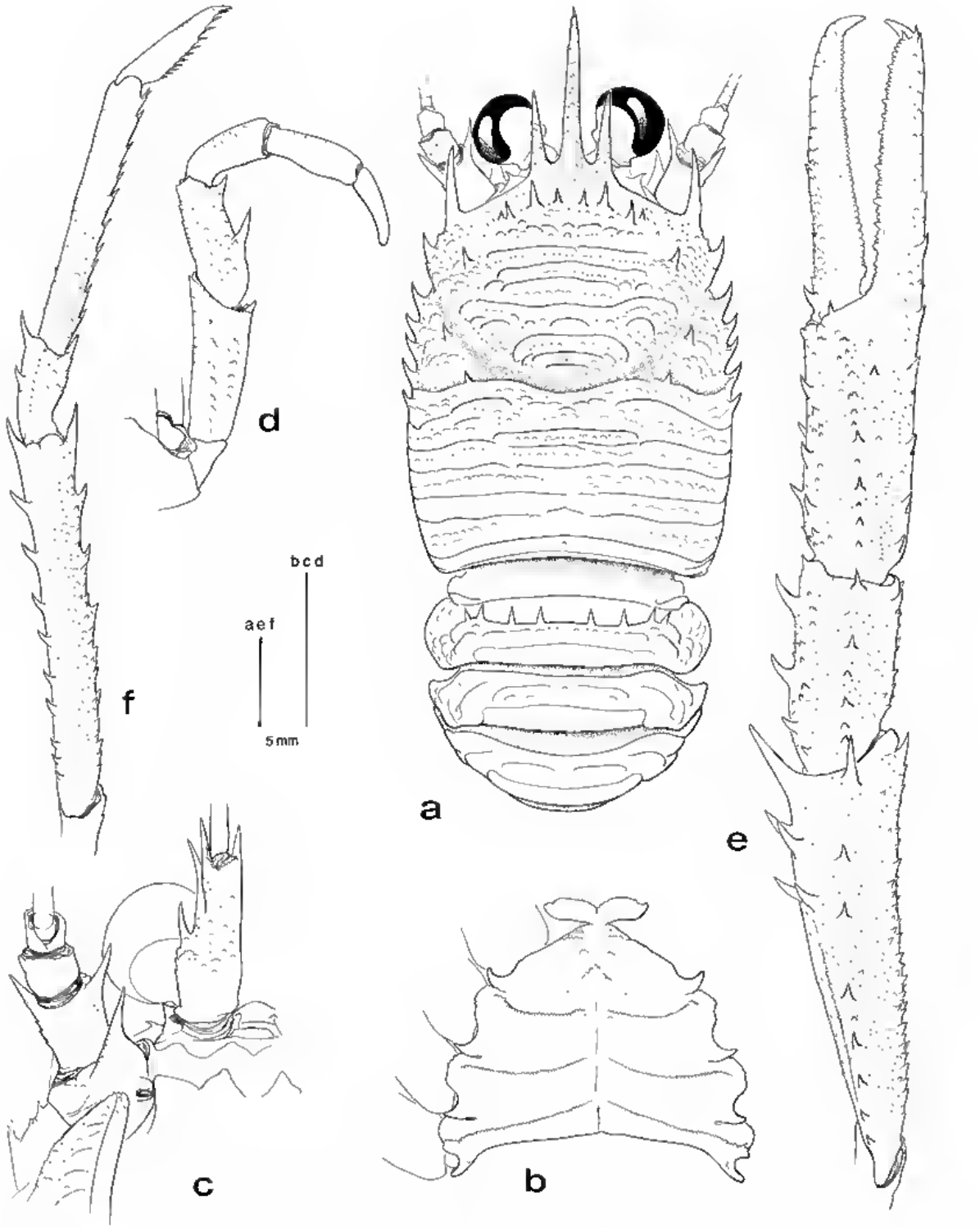


FIG. 6. — *Munida rubella* sp. nov. : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e right cheliped, dorsal view ; f right second pereiopod, lateral view ; a, e, f : holotype, male 21.5 mm (MNHN Ga 1994) ; b, c, d : paratype, female 21 mm (MNHN Ga 1698).

Source : MNHN, Paris

♂ 21.5 mm (holotype, MNHN Ga 1994), 1 ♂ 26 mm (MNHN Ga 2026) ; Mururoa, 28.06.1988, 560-600 m, trap : 1 ♂ 22 mm (MNHN Ga 1991) – **Tubai Islands**, Rimitara, 03.09.1988, 500-700 m, trap : 1 ♂ 23 mm (MNHN Ga 1895).

TYPES. — One male (21.5 mm) from station 326, Tuamotu Islands (Fangataufa) has been selected as holotype (MNHN Ga 1994). The other specimens are paratypes.

ETYMOLOGY. — From the Latin *rubellus*, reddish, referring to the general colouration of the species.

DIAGNOSIS. — Carapace with numerous striae, dorsally armed with 5-6 pairs of epigastric spines ; parahepatic, anterior branchial and postcervical spines present in most specimens. Without small median depression on intestinal region. Frontal margins nearly horizontal. Rostrum slightly curved and horizontal. Supraocular spines reaching midlength of rostrum and end of corneas. Anterolateral spine three times longer than following spine. Branchial margins with five spines. Lateral surface of fifth to seventh thoracic sternites without marked carinae. Second abdominal segment with four pairs of spines and two striae. Eyes large. Distomesial spine of antennular basal segment shorter than lateral. Distal spine of basal segment of antennal peduncle about as long as second antennal segment. Distomesial spine on second antennal segment shorter than antennal peduncle. Merus of third maxilliped with two spines on flexor margin, extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Fixed fingers of chelipeds armed with proximal spines. Dactylus of walking legs *c.* one-half propodus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with short, not iridescent setae. Main transverse striae on posterior part of carapace interrupted in cardiac region. Numerous small scales between main striae. No median depression on intestinal region. Gastric region with a row of five pairs of epigastric spines, pair just behind supraocular spines being the largest. One parahepatic, one branchial anterior and one postcervical spine on each side.

Frontal margins slightly oblique. Lateral margins feebly convex. Anterolateral spine well developed, situated at anterolateral angle, distinctly overreaching the level of sinus between rostrum and supraocular spines. Second marginal spine before cervical groove three times smaller than preceding one. Branchial margins with five spines decreasing in size posteriorly.

Rostrum spiniform, half as long as remaining carapace, slightly sinuous and horizontal. Supraocular spines reaching midlength of rostrum and end of corneas, slightly divergent, upwardly directed.

Fourth thoracic sternite with some short granulated striae ; lateral surface of fifth to seventh sternites smooth, without granules or marked carinae. Transverse ridges between fifth, sixth and seventh sternites obtuse, feebly granulated.

Second abdominal tergite with one row of four pairs of spines on anterior border. Second tergite with two transverse striae, anterior stria weak and scaly, posterior one well marked and uninterrupted. Third and fourth abdominal tergites each with one transverse continuous stria and one additional weak stria interrupted medially and situated anterior to main one. Fifth tergite with two continuous striae.

Eyes large, maximum corneal diameter about one-third the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) *c.* one quarter carapace length, elongate, overreaching corneas, with two distal spines, mesial spine shorter than lateral spine ;

Source : MNHN, Paris

and two spines on lateral margin, proximal one short, located at midlength of segment, distal one long, not overreaching distolateral spine.

First segment of antennal peduncle with one strong distal spine on mesial margin ; second segment with two long distal spines, mesial spine longer than lateral spine, reaching end of penultimate segment, although not overreaching antennal peduncle ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus measured along dorsal margin, distoventrally bearing spine. Merus of third maxilliped bearing two well developed spines on flexor margin, distal smaller ; extensor margin unarmed.

Chelipeds subequal, squamous, with numerous setae more dense on mesial borders of articles. Right cheliped *c.* 3.5 times as long as carapace. Merus as long as carapace, slightly more than twice as long as carpus and nearly twice as long as palm ; palm slightly more than twice as long as high and nearly as long as fingers. Merus armed with four rows of spines. Carpus with several spines on dorsal side and several spines scattered on mesial and ventral sides. Palm with several spines scattered on mesial and dorsal sides and one row of dorsolateral spines, not continued onto fixed finger. Fingers distally curving and crossing, ending in a sharp point ; each with one lateral and one mesial spine near the base ; fixed finger with two spines near tip ; cutting edges with small teeth of different sizes.

Walking legs slender, furnished with long, plumose, not iridescent setae on dorsal margin and short, dense setae on lateral borders. Second pereiopod slightly more than twice carapace length ; merus as long as carapace, *c.* 7 times as long as high, *c.* 4 times carpus length and 1.5 times as long as propodus ; propodus *c.* 7.5 times as long as high, slightly more than twice dactylus length. Merus with one row of 10-11 spines on dorsal border, increasing in size distally, ventral margin with one long distal spine, one additional spine, and two projecting scales on distal half. Carpus with two or three dorsal spines and one distoventral spine. Propodus with 11-16 movable ventral spines. Dactylus with dorsal margin slightly convex on proximal half, slightly curving distally, with 10-11 movable spinules along ventral margin. Third pereiopod similar to second ; fourth pereiopod shorter than second and third. Merus of fourth pereiopod half length of second pereiopod. Epipods absent from all pereiopods.

Colour : Ground colour of carapace and abdominal segments orange, telson pinkish. Cervical groove whitish. Rostrum and spines on carapace and second abdominal segment red. Antennular and antennal peduncles red. Chelipeds and walking legs with transverse red and light orange bands. Fingers of chelipeds red, except for the proximal part light orange. Dactylus of walking legs red.

VARIATIONS. — The anterolateral spine on the carapace is always more than three times longer than the following spine (in one specimen four times). The postcervical spines may be absent. As in most species of *Munida* the number of secondary striae and scales on the carapace changes with size, being more numerous in larger individuals. All other important specific characters remain constant. The length of the chelipeds in the females examined is *c.* 2.5 times the carapace length, with the merus as long as the carapace. In males, the length of the chelipeds is more than 3.5 times the carapace length, the merus being as long or slightly longer than the carapace.

Source : MNHN, Paris

REMARKS. — *Munida rubella* is close to *M. amathea* sp. nov., however, they differ in several constant characters :

— *Munida amathea* has a small, median, smooth depression on the intestinal region, with the surface devoid of striae or scales ; in *M. rubella* there is a short stria at the same position ;

— the anterolateral spine, three or more times the size of the following spine, is very long in *M. rubella* ; the same spine is only slightly larger than the following one in *M. amathea*.

If specimens of similar sizes of the two species are compared, *M. rubella* shows a carapace clearly more squamous than *M. amathea* ; in the latter, the secondary striae and scales are practically absent at all sizes examined, whereas in *M. rubella* the secondary striae and scales are less numerous only in small specimens

SIZE. — The males examined ranged between 17 and 26 mm, the females between 12.5 and 21 mm. Ovigerous females from 20 mm.

DISTRIBUTION. — Society (Tahiti), Tuamotu (Mururoa, Fangataufa) and Tubuai (Rimatara) Islands. Depths between 500 and 700 m.

7. **Munida plexaura** sp. nov.

(Fig. 7 ; pl. IE)

MATERIAL EXAMINED. — **Tuamotu Islands**, Fakarava, stn D25, 07.06.1990, 16°07.33'S, 145°49.16'W, 398 m, dredge : 1 ♀ ov. 10 mm (holotype, MNHN Ga 1906) ; Mururoa (without position), 1984 : 1 ♂ 16 mm, 1 ♀ ov. 13.5 mm (MNHN Ga 1907). — **Tubuai Islands**, Raevavae, stn 344, 01.12.1990, 23°53.3'S, 147°36.1'W, 350 m, trap : 1 ♀ ov. 10 mm (MNHN Ga 2030)

TYPES. — One ovigerous female (10 mm) from the Tuamotu Islands (Fakarava) has beem selected as holotype (MNHN Ga 1906). The other specimens are paratypes.

ETYMOLOGY. — The name refers to one of the Nereids of Greek mythology (Plexaura).

DIAGNOSIS. — Carapace with numerous striae, dorsally armed with 2-3 pairs of epigastric spines ; parahepatic and postcervical spines present. Frontal margins oblique. Rostrum slightly curved. Supraocular spines not reaching midlength of rostrum and end of corneas. Branchial margins armed with three spines. Lateral surface of fifth to seventh thoracic sternites without marked carinae. Second abdominal segment unarmed, with two transverse striae. Eyes large. Distal spines of antennular basal segment subequal in size. Distal spine of basal segment of antennal peduncle short, reaching a little over midlength of second segment. Merus of third maxilliped with 2-3 spines on flexor margin, extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Chelipeds with fixed and movable fingers armed with row of spines along dorsolateral and mesial margins, respectively, and several spines on dorsal border. Dactylus of walking legs *c* half propodus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with short, dense, not iridescent setae. Main transverse striae on posterior part of carapace interrupted in

Source : MNHN, Paris

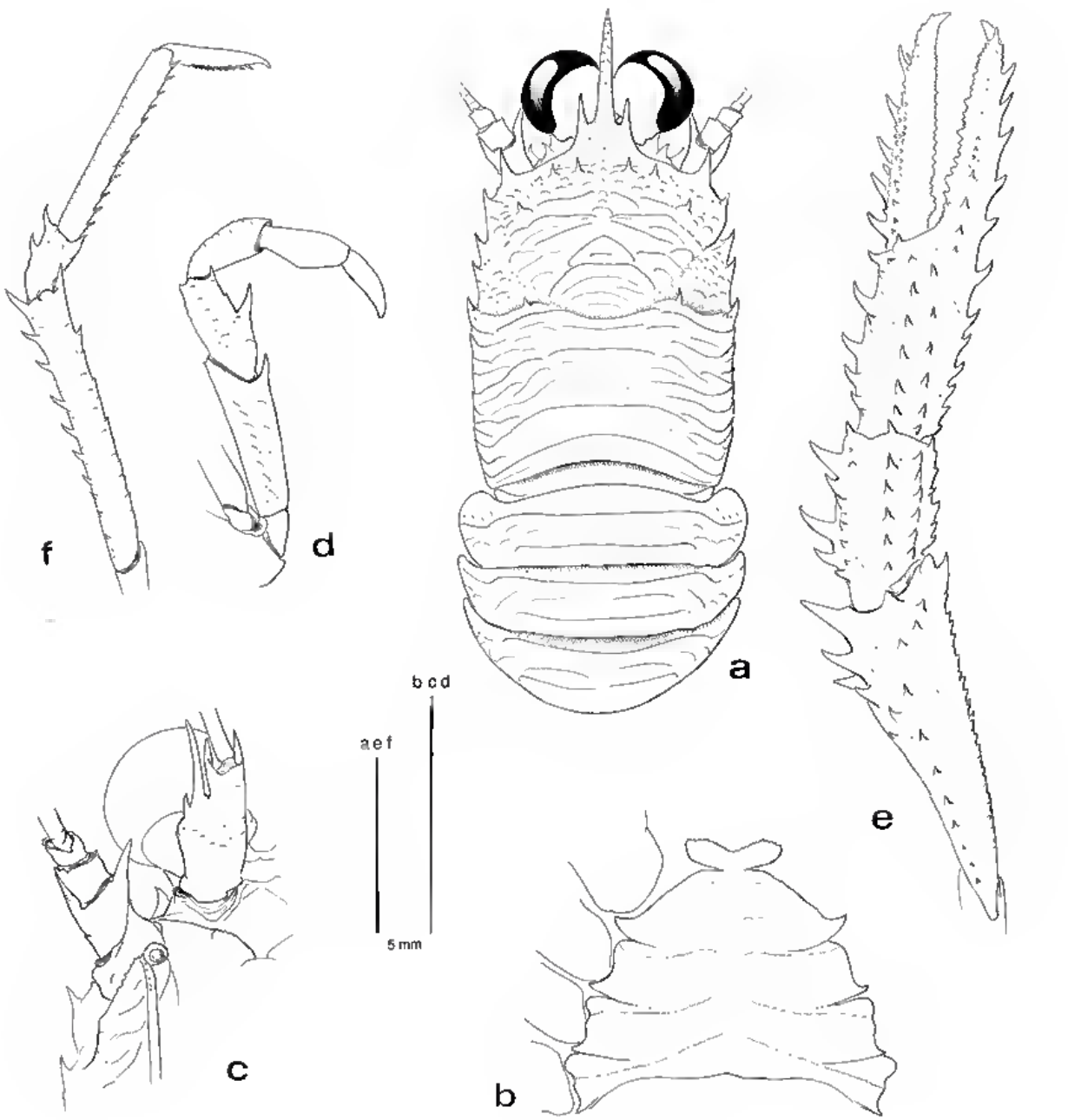


FIG. 7. — *Munida plexaura* sp. nov., holotype, female 10 mm (MNHN Ga 1906) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

cardiac region. Numerous secondary striae. Hepatic, gastric and anterobranchial regions squamous. Gastric region with one row of two pairs of epigastric spines, of similar size. One parahepatic and one postcervical spine on each side.

Frontal margins oblique. Lateral margins almost straight. Anterolateral spine short, not reaching to the level of sinus between rostrum and supraocular spines. Second marginal spine before cervical groove. Branchial margins with three spines of similar sizes.

Rostrum spiniform, half as long as remaining carapace, slightly sinuous and horizontal. Supraocular spines short, not reaching to midlength of rostrum and end of corneas, parallel and upwardly directed.

Fourth thoracic sternite with some short granulated striae; lateral surface of fifth to seventh sternites without marked carinae. Transverse ridges between fifth, sixth and seventh sternites obtuse, finely granulated.

Abdominal tergites unarmed. Second to fifth tergites each with two transverse striae. Anterior stria weak and interrupted medially on all tergites, posterior stria continuous on 2nd, 3rd and 5th tergites, interrupted medially on 4th.

Eyes large, maximum corneal diameter more than one-third the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) *c.* one-quarter carapace length, elongate, although not overreaching corneas, with two long subequal distal spines; two spines on lateral margin, proximal one short, located at midlength of segment, laterodistal long, overreaching distal spines.

First segment of antennal peduncle with one strong short distal spine on mesial margin, not overreaching second segment; second segment with two long distal spines, mesial spine longer than lateral spine and reaching end of third segment; penultimate segment unarmed.

Ischium of third maxilliped *c.* twice length of merus, distoventrally bearing spine. Merus of third maxilliped bearing two spines on flexor margin, distal smaller; a small acute granule between these two spines. Extensor margin unarmed.

Chelipeds squamous, subequal, with numerous short setae, more dense on mesial borders of articles. Right cheliped *c.* 3 times as long as carapace. Merus slightly longer than carapace length, almost twice as long as carpus and *c.* twice as long as palm; palm *c.* 1.5 times longer than high and nearly as long as fingers. Merus armed with four rows of spines. Carpus with two rows of spines on dorsal side, several spines ranged in rows on mesial, lateral and ventral sides. Palm with one row of strong mesial spines, with some additional spines scattered on mesial border; two rows of small dorsal spines and one row of strong dorsolateral spines, continuing onto fixed finger and reaching tip. Movable finger with one row of strong mesial spines reaching tip. Both fingers with small dorsal spines on proximal half. Fingers distally curving and crossing, ending in a sharp point. Cutting edges with small teeth of various sizes.

Walking legs slender, furnished with long, plumose, iridescent setae on dorsal margin and with a few short setae on lateral borders. Second pereiopod *c.* twice carapace length. Merus slightly shorter than carapace, slightly more than 7 times as long as high, nearly 4 times carpus length and 1.5 times as long as propodus; propodus 8 times longer than high and *c.* twice dactylus length. Merus with one row of 9-10 spines on dorsal border, increasing in size distally, ventral edge with one long distal spine and one additional spine and one projecting scale on distal half. Carpus with one long distal spine on dorsal and ventral borders, one additional dorsal spine. Propodus with one row of 12-13 movable spines on ventral margin. Dactylus

Source : MNHN, Paris

moderately long, its dorsal margin straight, slightly curving distally, with 9-10 movable spinules along ventral margin. Third pereiopod similar to second, although slightly shorter. Fourth shorter, less spinulated than second and third. Merus of fourth pereiopod 1/2 times that of second pereiopod. Epipods absent from all pereiopods.

Colour : Carapace with wide transverse yellow and purple bands. Epigastric region with a large purple spot, followed by a yellow band. A purple band along cervical groove, followed by a yellow band. A purple band situated on posterior part of carapace ; posterolateral angles of carapace yellow. Second to fourth abdominal segments with a wide medial yellow spot, purple laterally. Fifth and sixth abdominal segments and telson whitish. Tip of the rostrum and frontal margins red. Colour of chelipeds and walking legs not clearly discernible on the colour transparency, although several bands are present, a dorsal red spot on anterior half of movable finger.

VARIATIONS. — In the male paratype there are three pairs of epigastric spines. The supraocular spines are convergent in one of the paratypes, where the merus of the third maxilliped has three ventral spines. The male of 16 mm has the chelipeds three times longer than the carapace, whereas in the ovigerous female of 13.5 mm the chelipeds are 2.5 times the carapace length.

REMARKS. — *Munida plexaura* is close to *M. evarne* sp. nov., however, they can be distinguished by several features (see remarks under that species).

Munida plexaura is also related to *M. sentai* Baba, 1986, from the Andaman Sea (BABA, 1986 ; 1988). However, they differ in several constant characters :

— in *Munida sentai* the hepatic region is furnished with several small spines and the anterior branchial region with spinous tubercles ; in *M. plexaura* these spines and tubercles are absent ;

— in the new species, the distomesial spine of the basal segment of the antennal peduncle is very short not reaching to the end of the second segment ; in *M. sentai* this spine distinctly overreaches the second segment.

SIZE. — The male examined measured 16 mm, the ovigerous females ranged between 10 and 13.5 mm.

DISTRIBUTION. — Tuamotu (Fakarava, Mururoa) and Tubuai (Raevavae) Islands, 350-398 m depth.

8. **Munida lenticularis** sp. nov.
(Fig. 8 ; pl. IF)

MATERIAL EXAMINED. — **Tuamotu Islands**, Mururoa, 28.11.1989, 21°46.8'S, 138°52.1'W, 200 m, trap : 1 ♂ 11.5 mm (holotype MNHN Ga 1903), 1 ♂ 11.5 mm, 1 ♀ ov. 11 mm (paratypes, MNHN Ga 1904).

Source : MNHN, Paris

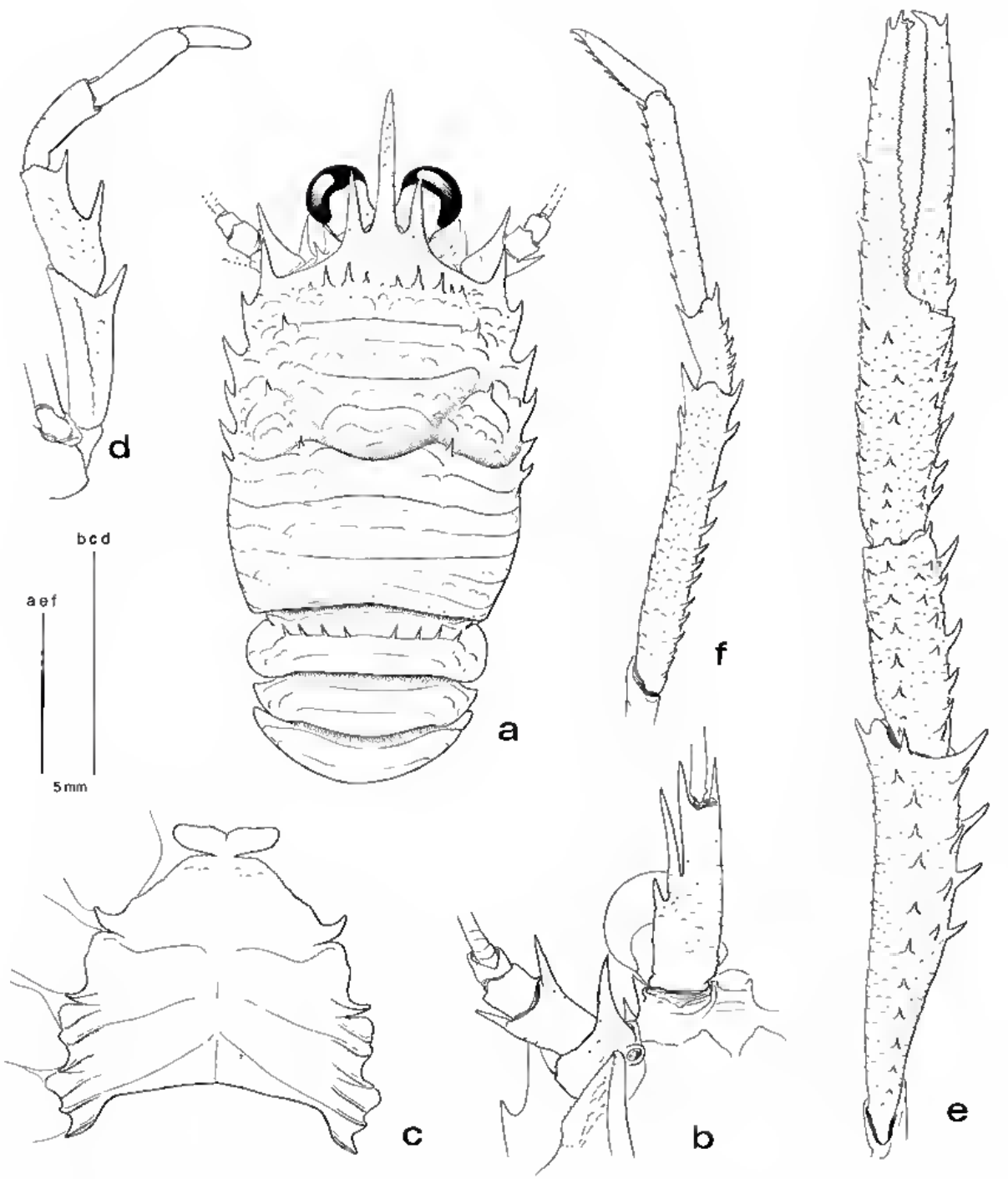


FIG. 8. — *Munida lenticularis* sp. nov., holotype, male 11.5 mm (MNHN Ga 1903) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

ETYMOLOGY. — From the Latin *lenticula*, dark, freckle, in reference to the two round spots on anterior branchial regions.

DIAGNOSIS. — Carapace dorsally armed with 8-9 epigastric spines ; parahepatic, anterior branchial and postcervical spines present. Frontal margins slightly oblique. Rostrum slightly curved. Supraocular spines reaching to midlength of rostrum and end of corneas. Branchial margins with four spines. Lateral surface of fifth to seventh thoracic sternites with marked carinae. Second abdominal tergite with four pairs of spines and one transverse stria. Eyes small. Distal spines of antennular basal segment subequal in size. Distal spine of basal antennal peduncle slightly overreaching second segment of antennal peduncle. Merus of third maxilliped with two marginal spines on flexor margin, extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Fixed fingers of chelipeds armed with one row of spines along lateral border, movable finger with several spines on proximal half. Dactylus of walking legs about half length of propodus.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with short, not iridescent setae. Main transverse striae on posterior part of carapace interrupted in cardiac region. Secondary striae almost absent in branchial regions. Gastric region with one row of nine epigastric spines, largest pair just behind supraocular spines. One parahepatic, one anterior branchial and one postcervical spine on each side.

Frontal margins slightly oblique. Lateral margins slightly convex. Anterolateral spine well developed, situated at anterolateral angle, not reaching to the level of sinus between rostrum and supraocular spines. Second marginal spine before cervical groove smaller than preceding one. Branchial margins with four spines decreasing in size posteriorly.

Rostrum horizontal, slightly sinuous, half as long as remaining carapace. Supraocular spines reaching midlength of rostrum and end of corneas, subparallel, and slightly directed upwards.

Fourth thoracic sternite with a few short granulated striae ; fifth to seventh sternites with short distinct carinae on lateral surfaces, without striae or granules. Transverse ridges between fifth, sixth and seventh sternites obtuse.

Second abdominal tergite with one row of four pairs of spines on anterior border. Second and third abdominal tergites with one transverse continuous stria. Fourth and fifth tergites with one weak stria interrupted medially.

Eyes small, maximum corneal diameter about one-quarter the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded), *c.* one-third carapace length, elongate, clearly overreaching corneas, with two long subequal distal spines ; and two spines on lateral margin, proximal one short, located at midlength of segment, distolateral long, not overreaching distal spines.

First segment of antennal peduncle with one strong spine on mesial margin, slightly overreaching second segment ; second segment with two long distal spines, reaching end of penultimate segment ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus measured along extensor margin, distoventrally bearing spine. Merus bearing two well developed spines on flexor margin, distal smaller. Extensor margin unarmed.

Source : MNHN, Paris

Chelipeds squamous, right cheliped longer and stouter than left, with numerous short setae, more dense on mesial borders of articles. Right cheliped 3.5 times (left 3.2 times) as long as carapace. Merus slightly longer than carapace length, 1.5 times longer than carpus and *c.* 1.5 times longer than palm ; palm *c.* 1.5 times as long as high and as long as fingers. Merus of right cheliped armed with four rows of spines. Carpus with several spines scattered on dorsal, mesial and ventral sides. Palm with two rows of mesial spines, one row of dorsal spines and one row of lateral spines, continuing on the whole length of fixed finger. Fingers distally curving and crossing, with a distal spine, ending in sharp point. Movable finger with one mesial spine near its base and three spines on proximal half of dorso-mesial margin. Cutting edges with small teeth of different sizes. Right cheliped strongly gaping

Walking legs slender, furnished with long, plumose, non iridescent setae on dorsal margin and some setae scattered on lateral sides. Second pereiopod twice carapace length. Merus of second pereiopod as long as carapace, 6 times as long as high, 4 times carpus length and 1.5 times as long as propodus ; propodus slightly more than 7 times as long as high and twice dactylus length. Merus with one row of 12-13 spines on dorsal border, one distal spine and one additional spine on ventral margin, distal spines both prominent. Carpus with long distal spine on dorsal and ventral borders, and four additional dorsal spines. Propodus with one row of ten movable ventral spines. Dactylus with dorsal margin slightly convex on proximal half, slightly curving distally, with 7-8 movable spinules along ventral margin. Third pereiopod similar to second, although slightly shorter. Fourth pereiopod shorter than second and third, less spinulated. Merus of fourth pereiopod *c.* 3/4 length of second pereiopod. Epipods absent from all pereiopods.

Colour : Body red, with several transverse white bands on carapace and abdominal segments. A white spot on epigastric region behind rostrum and another spot on each hepatic region, near carapace margin. A round red spot, encircled by white, on each anterior branchial region. Rostrum and spines on carapace reddish. Chelipeds with whitish and red bands. Distal half of fingers white. Tip of dactylus of walking legs red.

VARIATIONS. — No significative variations have been observed in the specimens examined. The female paratype has the chelipeds about three times longer than the carapace.

REMARKS. — This species somewhat resembles *M. pasithea* sp. nov., but it differs in the following aspects :

— the frontal margins are clearly more oblique in *M. pasithea* ;

— the distal spines of the basal antennular segment are short in *M. pasithea* whereas in *M. lenticularis* these spines are well developed ;

— the movable fingers of the chelipeds, in *M. pasithea*, have a row of spines on the whole length of the mesial border ; in *M. lenticularis*, these spines are limited to the proximal half of the finger ;

— the dactyli of the walking legs are more slender in *M. lenticularis*, being about half the length of the propodus ; in *M. pasithea*, the dactyli are more elongate and only slightly shorter than the propodi.

Munida lenticularis is also close to *M. ocellata* sp. nov., but they differ in the following aspects :

Source : MNHN, Paris

— the basal segment of the antennular peduncle has two long subequal distal spines in *M. lenticularis*, whereas in *M. ocellata* the distomesial spine is shorter than the distolateral spine ;

— the chelipeds are different : in *M. ocellata* the palm is more setose, the setae covering entirely the palm, specially in larger males ; in *M. lenticularis*, the palm is moderately setose, the setae being dense only on the mesial border ;

— the fixed finger of the chelipeds, in *M. lenticularis*, has one row of spines along its lateral border whereas in *M. ocellata*, the spines are limited to the proximal half of the finger. The movable finger has only one proximal spine in *M. ocellata*, whereas there is a dorsomesial row of 3-4 spines in *M. lenticularis*.

SIZE. — The males examined measured 11.5 mm, the ovigerous female 11 mm.

DISTRIBUTION. — Tuamotu (Mururoa) Islands, 200 m depth.

9. **Munida ocellata** sp. nov.
(Fig. 9 ; pl. IG, H)

MATERIAL EXAMINED. — **Society Islands**, Raiatea, stn D31, 21.06.1990, 16°41.66'S, 151°26.34'W, 280 m, dredge : 1 ♂ 9.5 mm (MNHN Ga 1912). — **Tuamotu Islands**, Akiaki, 10.06.1989, 18°32'S, 139°12'W, 250-300 m, trap : 3 ♂ 11-11.5 mm (MNHN Ga 1913) ; Gambier, 14.06.1989, 23°00.6'S, 134°58.6'W, 300 m, trap : 4 ♂ 8.5-12 mm (MNHN Ga 1911) ; Gambier, Acteons Maria, stn 241, 30.05.1990, 22°00.9'S, 136°12.5'W, 380 m, trap : 1 ♂ 13.5 mm (holotype MNHN Ga 1909), 11 ♂ 10.5 to 12.5 mm, 4 ♀ ov. 9 to 10.5 mm, 2 ♀ 10.5 and 11 mm (MNHN Ga 1910) ; Mururoa, 28.11.1989, 21°46.8'S, 138° 52.1'W, 200 m, trap : 3 ♂ 10.5 to 12 mm (MNHN Ga 2025) ; Mururoa (without position), 1984 : 2 ♂ 6.5 and 9.5 mm, 1 ♀ ov. 7.5 mm (MNHN Ga 1914) ; Y. PLESSIS coll., 1 mile offshore, trap : 1 ♂ 13 mm, 1 ov. ♀ 8.5 mm (MNHN Ga 1915). — **Tubuai Islands** (Îles Australes), Raevavae, stn 344, 01.12.1990, 23°53,3'S, 147°36.1'W, 350 m, trap : 2 ov. ♀ 9 and 10.5 mm (MNHN Ga 2028) ; Maria, stn 353, 08.12.1990, 21°47.6'S, 154°42.1'W, 310 m trap : 3 ♂ 9 to 11 mm ; 1 ov. ♀ 6 mm (MNHN Ga 2029).

TYPES. — One male (13.5 mm) from the Tuamotu Islands (Gambier, Acteons Maria) has been selected as holotype (MNHN Ga 1909). The other specimens are paratypes.

ETYMOLOGY. — From the Latin *ocellus* in reference to the spots on the anterior branchial regions.

DIAGNOSIS. — Carapace dorsally armed with 4-5 pairs of epigastric spines ; parahepatic, anterior branchial and postcervical spines present. Frontal margins moderately oblique. Rostrum slightly curved. Supraocular spines slightly overreaching midlength of rostrum and end of corneas. Branchial margins with four spines. Fifth to seventh sternites with short marked carinae on lateral surfaces. Second abdominal segment with four pairs of spines and one transverse stria. Eyes small. Mesiodistal spine of antennular basal segment shorter than lateral. Distal spine of basal segment of antennal peduncle overreaching second segment. Merus of third maxilliped with two spines on flexor margin extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Chelipeds with fixed and movable fingers armed with spines only on first half. Dactylus of walking legs less than half propodus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with short and dense setae, and some long setae scattered on carapace. Setae not iridescent. Main transverse

Source : MNHN, Paris

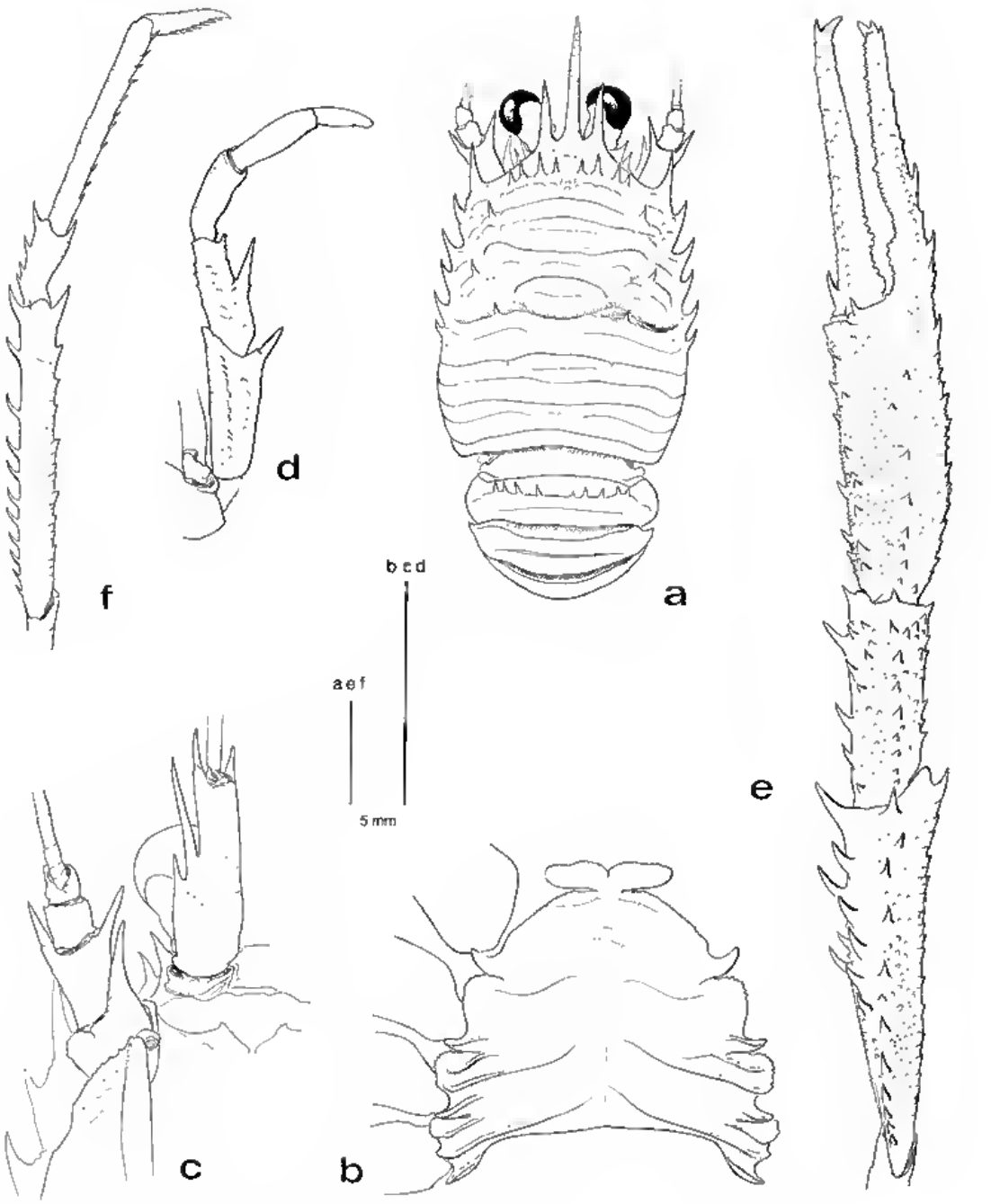


FIG. 9. — *Munida ocellata* sp. nov., holotype, male 13.5 mm (MNHN Ga 1909) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles , d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

striae on posterior part of carapace interrupted in cardiac region. Secondary striae absent, only some scales between main striae. Gastric region with row of four pairs of epigastric spines, largest pair just behind supraocular spines. One parahepatic, one anterior branchial, and one postcervical spine on each side.

Frontal margins oblique. Lateral margins slightly convex. Anterolateral spine well developed situated at anterolateral angle, almost reaching to the level of sinus between rostrum and supraocular spines. Second marginal spine before cervical groove smaller than preceding one. Branchial margins with four spines decreasing in size posteriorly.

Rostrum horizontal, slightly curved upwards, half as long as remaining carapace. Supraocular spines reaching midlength of rostrum and end of corneas, subparallel and slightly upwardly directed.

Fourth thoracic sternite with few short granulated striae ; fifth to seventh sternites with short marked carinae on lateral surfaces, without striae and granules. Transverse ridges between fifth, sixth and seventh sternites obtuse.

Second abdominal tergite with one row of nine spines on anterior border. Second and third abdominal tergites with one transverse continuous stria. Fourth and fifth tergites without striae.

Eyes small, maximum corneal diameter *c.* 1/4 the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) *c.* 1/3 carapace length, elongate, clearly overreaching corneas, with two distal spines, mesial spine shorter than lateral spine ; and two spines on lateral margin, proximal one short, located at midlength of segment, distal one long, not overreaching distolateral spine.

First segment of antennal peduncle with one strong slightly curved spine on mesial margin overreaching second segment ; second segment with two long distal spines, overreaching penultimate segment, although not overreaching antennal peduncle ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus, distoventrally bearing spine. Merus bearing two spines on flexor margin, distal clearly smaller. Extensor margin unarmed.

Chelipeds squamous, subequal, slightly gaping, with numerous short setae more dense on mesial borders of articles. Palm fully covered by dense setae. Right cheliped *c.* 3.8 times as long as carapace. Merus slightly longer than carapace, *c.* 1.5 times longer than carpus and 1.5 times longer than palm ; palm nearly twice as long as high and nearly as long as fingers. Merus armed with four rows of spines. Carpus with several spines scattered on dorsal, mesial and ventral sides. Palm with two rows of mesial spines, one row of dorsal spines and one row of dorsolateral spines continuing onto proximal half of fixed finger. Movable finger with one proximal mesial spine. Fixed finger with two distal spines. Fingers slender, distally curving and crossing, ending in a sharp point, with one additional distal spine on movable finger and two on fixed finger. Cutting edges with small teeth of different sizes.

Walking legs slender, furnished with long, plumose setae, some of them iridescent, on dorsal margin and some short setae on lateral sides. Second pereiopod slightly more than twice carapace length. Merus as long as carapace, nearly 10 times as long as high, 3.5 times carpus length and *c.* 1.5 times as long as propodus ; propodus *c.* 11 times as long as high and *c.* 2.5 times dactylus length. Merus with row of 11-12 spines on dorsal border, increasing in size distally, one distal spine on ventral margin, both distal spines prominent. Carpus with long

Source : MNHN, Paris

distal spine on dorsal and ventral borders, three additional spines on dorsal margin. Propodus with row of 11-13 movable spines on ventral margin. Dactylus slightly curving distally, with 7-8 movable spinules along ventral margin. Third pereiopod similar to first, although slightly shorter. Fourth pereiopod shorter than second and third and less spinulated. Merus of fourth pereiopod *c.* half length of second pereiopod. Epipods absent from all pereiopods.

Colour : Carapace with wide transverse yellow-orange and light purple bands. Yellow-orange bands situated on mesogastric and antero-cardiac area and on posterior part of carapace. Each anterobranchial region with a yellow-orange spot, red on its posterior border and circled by whitish. Ground colour of chelipeds and walking legs orange. Distal part of palm reddish. Fingers with proximal third whitish.

VARIATIONS. — Several specimens have five pairs of epigastric spines and the fourth abdominal tergite smooth, without striae. The females examined have the chelipeds clearly less setose than the males, with the fingers longer than the palm. This difference is especially clear comparing females and males over 10 mm carapace length. On the other hand, the small males and the females have shorter chelipeds *c.* 3.1-3.3 times the carapace length and the palm about 2.7 times as long as high.

REMARKS. — This new species is closely related to *M. polynoe* sp. nov., however they may be easily distinguished by the following characters :

— the branchiolateral margins always have four spines in *M. ocellata*, but only three spines in *M. polynoe* ;

— in *M. ocellata* the fixed finger of the chelipeds have 2-3 spines on the proximal half of the dorso-lateral border ; in *M. polynoe* these spines are absent ;

— comparing specimens of similar size and sex, the chelipeds are clearly longer in *M. polynoe* : in *M. polynoe* the chelipeds are more than 4 times the carapace length, whereas in *M. ocellata* this ratio is at most 3,8 ;

— the basal segment of the antennular peduncle is more than one-third the carapace length in *M. polynoe*, whereas in *M. ocellata* this segment is less than one-third the carapace length ; on the other hand, the distal spines of this basal segment are short in *M. polynoe*, whereas in *M. ocellata* these spines are well developed.

Munida ocellata is also very close to *M. pulchra* sp. nov. (see remarks under that species).

SIZE. — The males examined ranged between 6.5 and 13.5 mm, females between 6 and 11 mm. Ovigerous females from 6 mm.

DISTRIBUTION. — Society (Raiatea), Tubuai (Raevavae, Maria) and Tuamotu (Akiaki, Gambier-Acteons Maria, Mururoa) Islands. Depths between 200 and 380 m.

10. **Munida pulchra** sp. nov.

(Fig. 10)

MATERIAL EXAMINED. — **Tubuai Islands**, Rurutu, stn 341, 28.11.1990, 22°26.5'S, 151°23.1'W, 300 m, trap : 1 ov. ♀ 7.5 mm (holotype, MNHN Ga 2031).

Source : MNHN, Paris

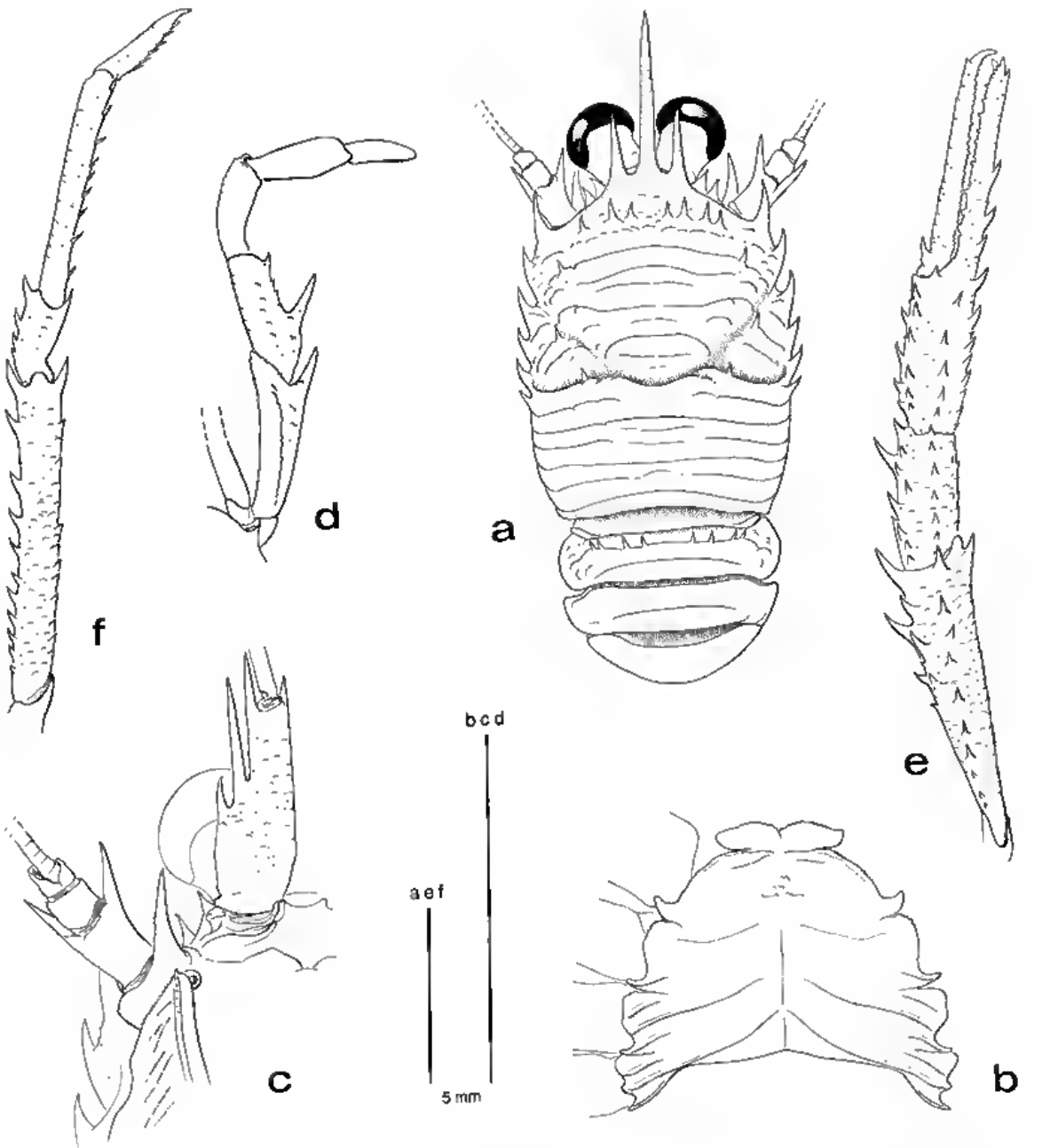


FIG. 10. — *Munida pulchra* sp. nov., holotype, female 7.5 mm (MNHN Ga 2031) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

ETYMOLOGY. — From the Latin *pulcher*, pretty, in reference to the nice colouration of the species.

DIAGNOSIS. — Carapace dorsally armed with four pairs of epigastric spines; parahepatic, anterior branchial and postcervical spines present. Frontal margins oblique. Rostrum slightly curved. Supraocular spines not quite reaching to midlength of rostrum and end of corneas. Branchial margins with four spines. Fifth to seventh thoracic sternites with short marked carinae on lateral surfaces. Second abdominal tergite with four pairs of spines and one transverse stria. Eyes large. Mesiodistal spine of antennular basal segment shorter than lateral. Distal spine of basal antennal peduncle overreaching second segment of antennal peduncle. Merus of third maxilliped with two spines on flexor margin, extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Fingers of chelipeds armed with spines only on the proximal half. Dactylus of walking legs less than half propodus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with some setae scattered on carapace. Main transverse striae on posterior part of carapace interrupted in cardiac region. Secondary striae absent, only some scales between main striae. Gastric region with one row of seven epigastric spines, largest pair just behind supraocular spines. One parahepatic, one branchial anterior and one postcervical spine on each side.

Frontal margins oblique. Lateral margins slightly convex. Anterolateral spine well developed, situated at anterolateral angle, almost reaching to the level of sinus between rostrum and supraocular spines. Second marginal spine before cervical groove somewhat smaller than preceding one. Branchial margins with four spines decreasing in size posteriorly.

Rostrum horizontal, slightly sigmoid, half as long as remaining carapace. Supraocular spines reaching to midlength of rostrum and end of corneas, subparallel, slightly directed upwards.

Fourth thoracic sternite with a few short granulated striae ; fifth to seventh sternites with short marked carinae on lateral surfaces, without striae or granules. Transverse ridges between fifth, sixth and seventh sternites obtuse.

Second abdominal tergite with one row of four pairs of spines on anterior border. Second and third abdominal tergites with one transverse continuous stria. Fourth and fifth tergites smooth.

Eyes moderately large, maximum corneal diameter more than one-third the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) *c.* one-third carapace length, elongate, clearly overreaching corneas, with two distal spines, mesial spine shorter than lateral one ; and two spines on lateral margin, proximal one short, located at midlength of segment, distolateral one long, but not overreaching distolateral spine.

First segment of antennal peduncle with one strong slightly curved spine on mesial margin, overreaching second segment ; second segment with two long distal spines, overreaching penultimate segment, although not overreaching antennal peduncle ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus, distoventrally bearing spine. Merus bearing two spines on flexor margin, distal clearly smaller. Extensor margin unarmed.

Chelipeds squamous, subequal, fingers slightly gaping, with numerous short setae more dense on mesial borders of articles. Palm fully covered by dense setae. Right cheliped *c.* 3 times as long as carapace. Merus as long as carapace, *c.* twice as long as carpus and twice as long

Source : MNHN, Paris

as palm ; palm 2.5 times as long as high and two-thirds length of fingers. Merus armed with four rows of spines. Carpus with several spines scattered on dorsal, mesial and ventral sides. Palm with two rows of mesial spines, one row of dorsal spines and one row of dorsolateral spines continuing along fixed finger, although not reaching beyond proximal half. Movable finger with one mesial spine near its base. Fixed finger with two spines near tip. Fingers slender, distally curving and crossing, ending in sharp point, with additional distal spine on movable finger and two on fixed finger. Cutting edges with small teeth of different sizes.

Walking legs slender, furnished with long, plumose setae (some of them iridescent) on dorsal margin, and some short setae on lateral borders. Second pereiopod slightly more than twice carapace length. Merus as long as carapace, nearly 6 times as long as high, 3.5 times carpus length and *c.* 1.5 times as long as propodus ; propodus *c.* 6 times as long as high and *c.* twice dactylus length. Merus with one dorsal row of 10-11 spines, increasing in size distally and with one ventral distal spine ; distal spines prominent. Carpus with long dorsal and ventral distal spines, and with three additional spines on dorsal margin. Propodus with one row of 10-11 movable ventral spines . Dactylus slightly curving distally, with 7-8 movable spinules along ventral margin. Third pereiopod similar to first, although slightly shorter. Fourth pereiopod shorter than second and third, less spinulated. Merus of fourth pereiopod about half length of second pereiopod. Epipods absent from all pereiopods.

REMARKS. — This new species is very close to *M. ocellata* sp. nov. from which it differs mainly by the colour pattern.

The only morphological character that distinguishes the only known specimen of *M. pulchra* from the numerous *M. ocellata* in the collection is relative to the size of the corneas : the maximum carneal diameter is more than 1/3 the length of the anterior border of the carapace between the bases of the anterolateral spines. In *M. ocellata*, this ratio is about 1/4.

Although *M. pulchra* is a brillantly coloured species (the only colour photograph has been unfortunately lost, so that this colouration cannot be described), it lacks the yellow-orange spots, circled with white, on the anterobranchial regions which are characteristic of *M. ocellata.*

DISTRIBUTION. — Tubuai (Rurutu), 300 m depth

11. **Munida longicheles** sp. nov.
(Fig. 11 ; pl. II)

MATERIAL EXAMINED. — **Tuamotu Islands**, Mururoa, stn D53, 17.10.1990, 21°51.45'S, 139°01.98'W, 439 m, dredge : 1 ♂ 8 mm (holotype, MNHN Ga 1998).

ETYMOLOGY. — The name refers to the chelipeds which are very long in this species.

DIAGNOSIS. — Carapace dorsally armed with four pairs of epigastric spines ; parahepatic, anterobranchial and postcervical spines present. Frontal margins slightly oblique. Rostrum straight. Supraocular spines reaching to midlength of rostrum and not end of corneas. Branchial margins with 3-4 spines. Fifth to seventh thoracic sternites with short marked carinae on lateral surfaces. Second abdominal tergite with two pairs of spines and one tranverse stria. Eyes moderately large. Mesiodistal spine of

Source : MNHN, Paris

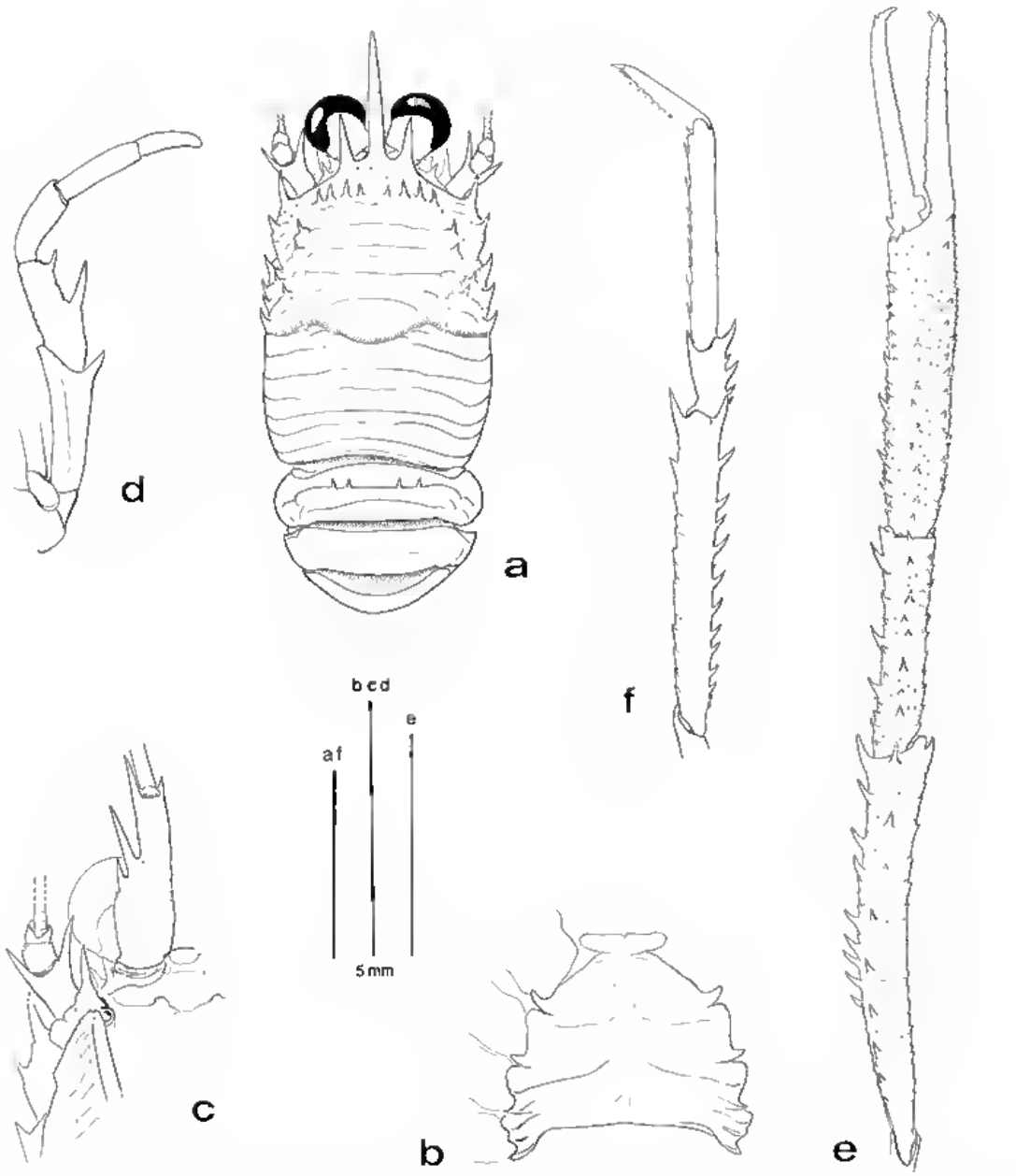
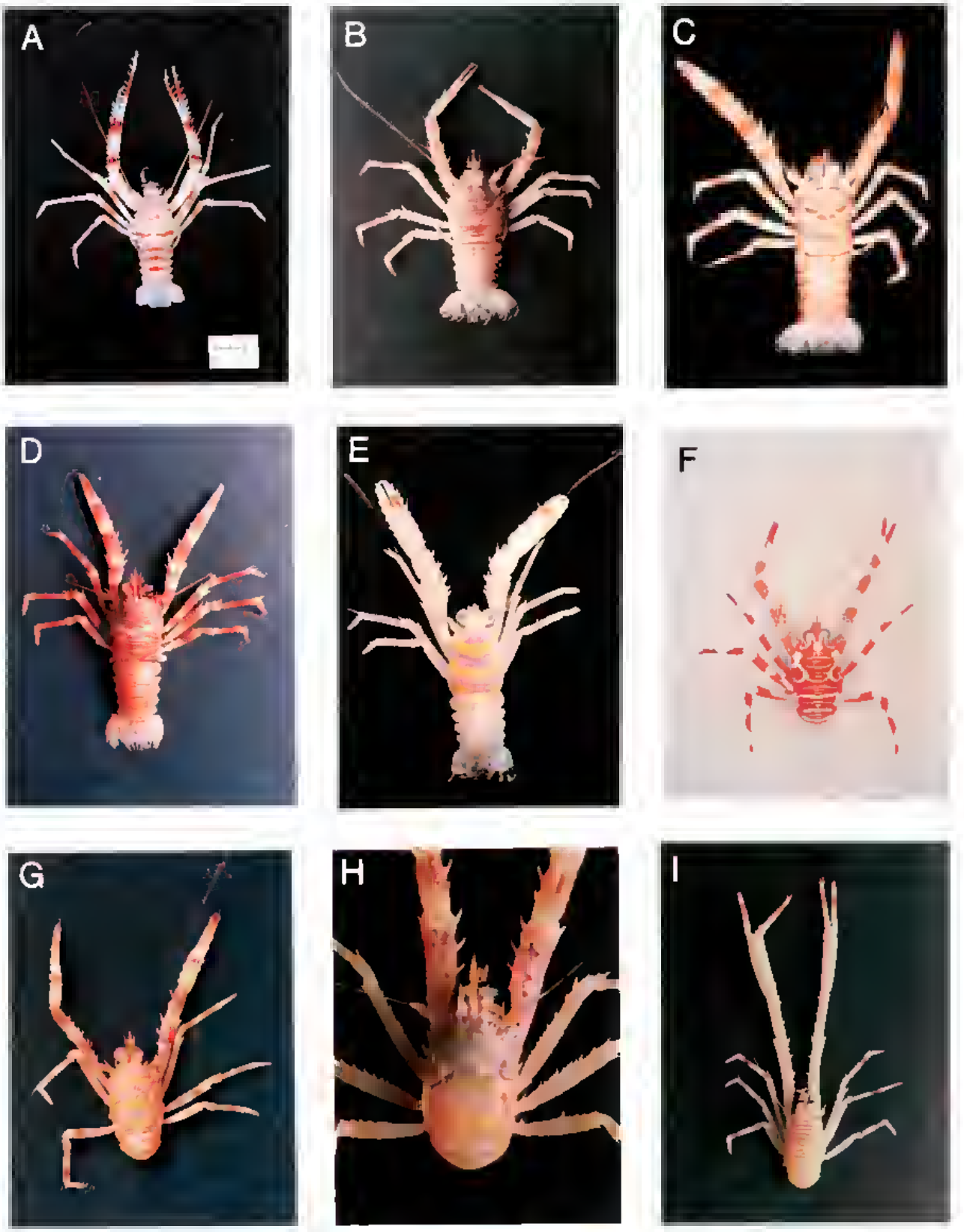


FIG. 11. — *Munida longicheles* sp. nov., holotype, male 8 mm (MNHN Ga 1998) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e right cheliped, dorsal view ; f right second pereiopod, lateral view.

PLANCHE I. — A, *Munida hystrix* sp. nov., male 13.5 mm, paratype (MNHN Ga 1918). B, *Munida profunda* sp. nov., ovigerous female 17 mm, holotype (MNHN Ga 1997). C, *Munida rubrovata* sp. nov., ovigerous female 12.5 mm, paratype (MNHN Ga 1901). D, *Munida rubella* sp. nov., female 12 mm, paratype (MNHN Ga 1992). E, *Munida plexaura* sp. nov., ovigerous female 10 mm, holotype (MNHN Ga 1906). F, *Munida lenticularis* sp. nov., male 11.5 mm, paratype (MNHN Ga 1904). G, *Munida ocellata* sp. nov., ovigerous female 9 mm, paratype (MNHN Ga 1910). H, *Munida ocellata* sp. nov., ovigerous female 10.5 mm, paratype (MNHN Ga 1910). I, *Munida longicheles* sp. nov., male 8 mm, holotype (MNHN Ga 1998).

Source : MNHN, Paris



Source : MNHN, Paris

Source : MNHN, Paris

antennular basal segment clearly shorter than lateral. Distal spine of basal antennal peduncle slightly overreaching second segment of antennal peduncle. Merus of third maxilliped with two spines on flexor margin ; extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Chelipeds with fingers almost unarmed. Propodus of second pereiopods more than twice dactylus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with short, not iridescent setae. Main transverse striae on posterior part of carapace interrupted in cardiac region. Secondary striae almost absent. Gastric region with one row of four pairs of epigastric spines, second and third pairs the largest, subequal. Two parahepatic spines on each side. Two spines on each anterior branchial region. One small postcervical spine on each side.

Frontal margins slightly oblique. Lateral margins slightly convex. Anterolateral spine well developed, situated at anterolateral angle, not reaching to the level of sinus between rostrum and supraocular spines. Second marginal spine before cervical groove smaller than preceding one. Right branchial margins with three spines of similar size. Left branchial margin with four spines, third spine smaller.

Rostrum straight, horizontal, *c.* half as long as remaining carapace. Supraocular spines reaching midlength of rostrum, and not end of corneas, subparallel and upwardly directed.

Fourth thoracic sternite smooth, without granulated striae ; fifth to seventh sternites with short, sharp carinae on lateral surfaces, without striae or granules. Transverse ridges between fifth, sixth and seventh sternites obtuse.

Second abdominal tergite with one row of two pairs of spines on anterior border. Second and third abdominal tergites with one transverse continuous stria. Fourth and fifth tergites smooth.

Eyes moderately large, maximum corneal diameter slightly more than 1/3 the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) 1/3 carapace length, elongate, clearly reaching beyond corneas, with two distal spines, mesial spine very small, much shorter than lateral spine ; and two spines on lateral margin, proximal one short, located at midlength of segment, lateral one long but not overreaching distolateral spine.

First segment of antennal peduncle with strong distal spine on mesial margin, slightly overreaching second segment ; second segment with two long distal spines, mesial spine longer than lateral spine, overreaching antennal peduncle ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus, distoventrally bearing spine. Merus bearing two spines on flexor margin, proximal well developed, distal small. Extensor margin unarmed.

Chelipeds moderately squamous, not gaping, subequal in length ; left cheliped slightly stouter than right ; short setae on mesial, dorsal and lateral borders of articles, more dense on palm. Cheliped *c.* 5 times carapace length. Merus *c.* 1.5 times carapace length, slightly longer than carpus and palm ; palm 4 times longer than high, slightly longer than fingers. Merus armed with four rows of spines. Carpus with several spines scattered on dorsal, mesial and ventral sides. Palm with several spines scattered on mesial and dorsal sides, one row of dorsolateral spines, not continuing along fixed finger. Movable finger with one mesial spine

Source : MNHN, Paris

near its base. Fingers distally curving and crossing, ending in sharp point, with two spines near tips. Cutting edges with small teeth of different sizes.

Walking legs slender, furnished with several long, plumose, iridescent setae on dorsal margins and with some short setae on lateral borders. Second pereiopod *c.* 2.5 times carapace length. Merus slightly longer than carapace, nearly 7 times as long as high, *c.* 4.5 times carpus length and 1.5 times as long as propodus ; propodus *c.* 10 times as long as high and less than twice dactylus length. Merus with one dorsal row of 11-13 spines, increasing in size distally, and with one distoventral spine, distal spines prominent. Carpus with long dorsal and ventral distal spines and 3-4 additional spines on dorsal margin. Propodus with one row of nine movable ventral spines. Dactylus with dorsal margin straight, slightly curving distally, with eight movable ventral spinules. Third pereiopod similar to second. Merus of fourth pereiopod half as long as that of second pereiopod. Epipods absent from all pereiopods.

Colour : Ground colour of carapace and abdomen light orange ; rostrum, frontal margins, and striae dark orange. Chelipeds and walking legs light orange. Chelipeds with median red band on fingers, distal part of fingers whitish. Walking legs with red band on terminal part of carpus and propodus.

REMARKS. — *Munida longicheles* is closely related to *M. polynoe* sp. nov., but they can be distinguished by several characters :

— the eyes are slightly more than 1/3 the distance between anterolateral spines in *M. longicheles* ; they are about 1/4 that distance in *M. polynoe* ;

— the anterolateral spines do not reach the sinus between rostrum and supraocular spines in *M. longicheles* ; in *M. polynoe*, the anterolateral spines distinctly overreach that sinus ;

— the propodus of the second pereiopods is less than twice the dactylus length in *M. longicheles*, whereas in *M. polynoe* it is more than twice that length.

Munida rufiantennulata Baba, 1969 (BABA, 1969, 1988) from Japan and the Philippines is also related to *M. longicheles*. Both species can be distinguished by small but constant differences :

— the mesial spine of the second segment of the antennal peduncle is very long in *M. longicheles*, reaching beyond the antennal peduncle. In *M. rufiantennulata* this spine never overreaches the antennal peduncle ;

— the distal half of the fingers is reddish in *M. rufiantennulata*, whitish in the new species.

DISTRIBUTION. — Tuamotu (Mururoa) Islands, 439 m depth.

12. **Munida polynoe** sp. nov.
(Fig. 12)

MATERIAL EXAMINED. — **Tuamotu Islands**, Fakarava, stn D25, 07.06.1990, 16°07.33'S, 145°49.16'W, 398 m, trap : 1 ♂ 9.5 mm (holotype, MNHN Ga 1987), 1 ♂ 8 mm (paratype, MNHN Ga 1988).

ETYMOLOGY. — The name refers to one of the Nereids of the Greek mythology (Polynoe).

Source : MNHN, Paris

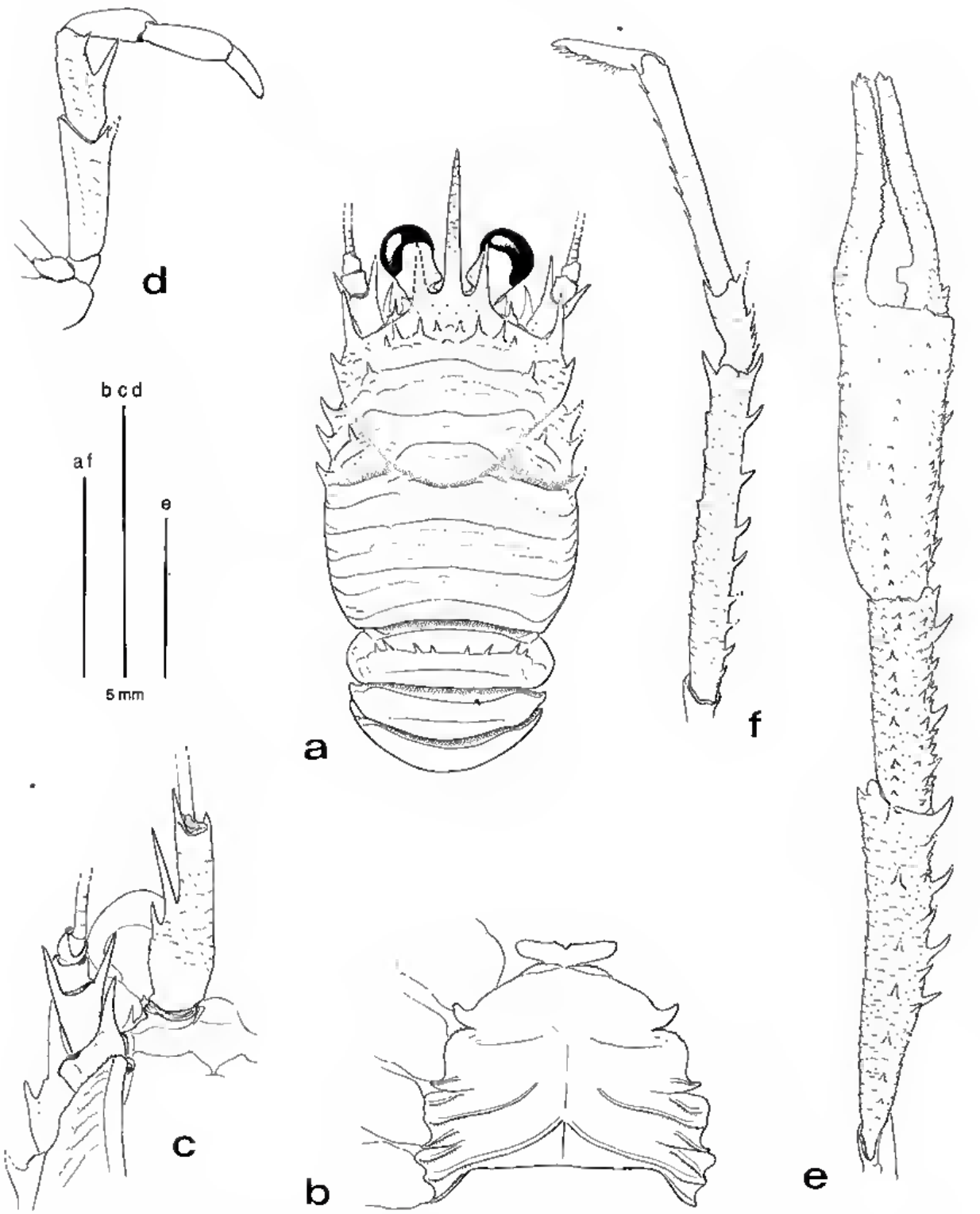


FIG. 12. — *Munida polynoe* sp. nov., holotype, male 9.5 mm (MNHN Ga 1987) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, left cheliped, dorsal view ; f, left second pereiopod, lateral view.

Source : MNHN, Paris

DIAGNOSIS. — Carapace dorsally armed with 3-4 pairs of epigastric spines ; parahepatic and anterior branchial spines present. Frontal margins slightly oblique. Rostrum straight. Supraocular spines reaching to midlength of rostrum and not end of corneas. Branchial margins with three spines. Fifth to seventh thoracic sternites with short distinct carinae on lateral surfaces. Second abdominal tergite with 2-4 pairs of spines and one transverse stria. Eyes small. Mesiodistal spine of antennular basal segment clearly shorter than lateral. Distal spine of basal antennal peduncle slightly overreaching second segment of antennal peduncle. Merus of third maxilliped with two spines on flexor margin ; extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Basal spine on movable finger. Propodus of second pereiopods more than twice dactylus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges mostly interrupted, with short, non iridescent setae. Main transverse striae on posterior part of carapace interrupted in cardiac region. Secondary striae almost absent. Gastric region with one row of four pairs of epigastric spines, second and third pair largest, subequal. One parahepatic and one branchial anterior spine on each side.

Frontal margins slightly oblique. Lateral margins slightly convex. Anterolateral spine well developed, situated at anterolateral angle, reaching to the level sinus between rostrum and supraocular spines. Second marginal spine before cervical groove smaller than preceding one. Branchial margins with three spines decreasing in size posteriorly.

Rostrum straight, horizontal, half as long as remaining carapace. Supraocular spines reaching to midlength of rostrum, but not to end of corneas, slightly divergent and upwardly directed.

Fourth thoracic sternite smooth, without granulated striae ; fifth to seventh sternites with short marked carinae on lateral surfaces, without striae or granules. Transverse ridges between fifth, sixth and seventh sternites obtuse.

Second abdominal tergite with one row of four pairs of spines on anterior border. Second and third abdominal tergites with one transverse continuous stria. Fourth and fifth tergites smooth.

Eyes small, maximum corneal diameter clearly less than 1/3 the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) more than 1/3 carapace length, elongate, overreaching corneas, with two distal spines, mesial spine small, much shorter than lateral spine ; and two spines on lateral margin, proximal one short, located at midlength of segment, distal one long, but not overreaching distolateral spine.

First segment of antennal peduncle with one strong distal spine on mesial margin, slightly overreaching second segment, and one small additional spinule on mesial margin ; second segment with two long distal spines, mesial spine longer than lateral spine, overreaching antennal peduncle ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus, distoventrally bearing spine. Merus bearing two spines on flexor margin, proximal well developed, distal small. Extensor margin unarmed.

Right cheliped missing. Left cheliped squamous, gaping, with short setae more dense on mesial, dorsal and lateral borders of articles. Cheliped more than 4 times carapace length.

Source : MNHN, Paris

Merus slightly longer than carapace, 1.5 times longer than carpus and slightly longer than palm ; palm *c.* 2.5 times longer than high and slightly longer than fingers. Merus armed with four rows of spines. Carpus with several spines scattered on dorsal, mesial and ventral sides. Palm with several spines scattered on mesial and dorsal sides, one row of dorsolateral spines, not continuing along fixed finger. Movable finger with one mesial spine near its base. Fingers distally curving and crossing, ending in sharp point, with two spines near tips. Cutting edges with small teeth of different sizes.

Walking legs slender, furnished with several long, plumose, iridescent setae on dorsal margin, and some short setae on lateral borders. Second pereiopod *c.* 2.5 times carapace length. Merus slightly longer than carapace, nearly 8 times as long as high, nearly 4 times carpus length and *c.* 1.5 times as long as propodus ; propodus *c.* 8 times as long as high and slightly more than twice dactylus length. Merus with one row of 8-9 spines on dorsal border increasing in size distally, distal spine on ventral margin, both distal spines prominent. Carpus with long dorsal and ventral distal spines, and additional spines on dorsal margin. Propodus with one row of ten movable ventral spines. Dorsal margin of dactylus straight, slightly curving distally, with eight movable ventral spinules. Third pereiopod similar to second. Epipods absent from all pereiopods.

VARIATIONS. — Paratype with three pairs of epigastric spines, one postcervical spine on left side only, and two pairs of spines on anterior margin of second abdominal tergite.

REMARKS. — *Munida polynoe* is closely related to *M. ocellata* sp. nov., but both are distinguishable by several characters (see remarks under *M. ocellata*).

The new species is also related to *M. rufiantennulata* Baba, 1969 (BABA, 1969, 1988) from Japan and the Philippines. A comparison of *Munida polynoe* with the type specimens of *M. rufiantennulata* (see BABA, 1969) shows that both species can be distinguished by small but constant differences :

— the mesial spine of the second segment of the antennal peduncle is very long in the new species, clearly reaching beyond the antennal peduncle ; in *M. rufiantennulata* this spine does not overreach the antennal peduncle ;

— the propodus of the second walking leg is more than twice the dactylus length in the new species, it is clearly shorter in *M. rufiantennulata.*

Munida polynoe is also close to *M. longicheles* sp. nov. (see remarks under that species).

SIZE. — The males examined measured 8 and 9.5 mm.

DISTRIBUTION. — Tuamotu (Fakarava) Islands, 398 m depth.

13. **Munida evarne** sp. nov.

(Fig.13)

MATERIAL EXAMINED. — **Tubuai Islands**, NW Rapa, Récif Neilson, 22.05.1979, 100-130 m, dredge : 1 ♂ 6.0 mm (holotype, MNHN Ga 1908).

Source : MNHN, Paris

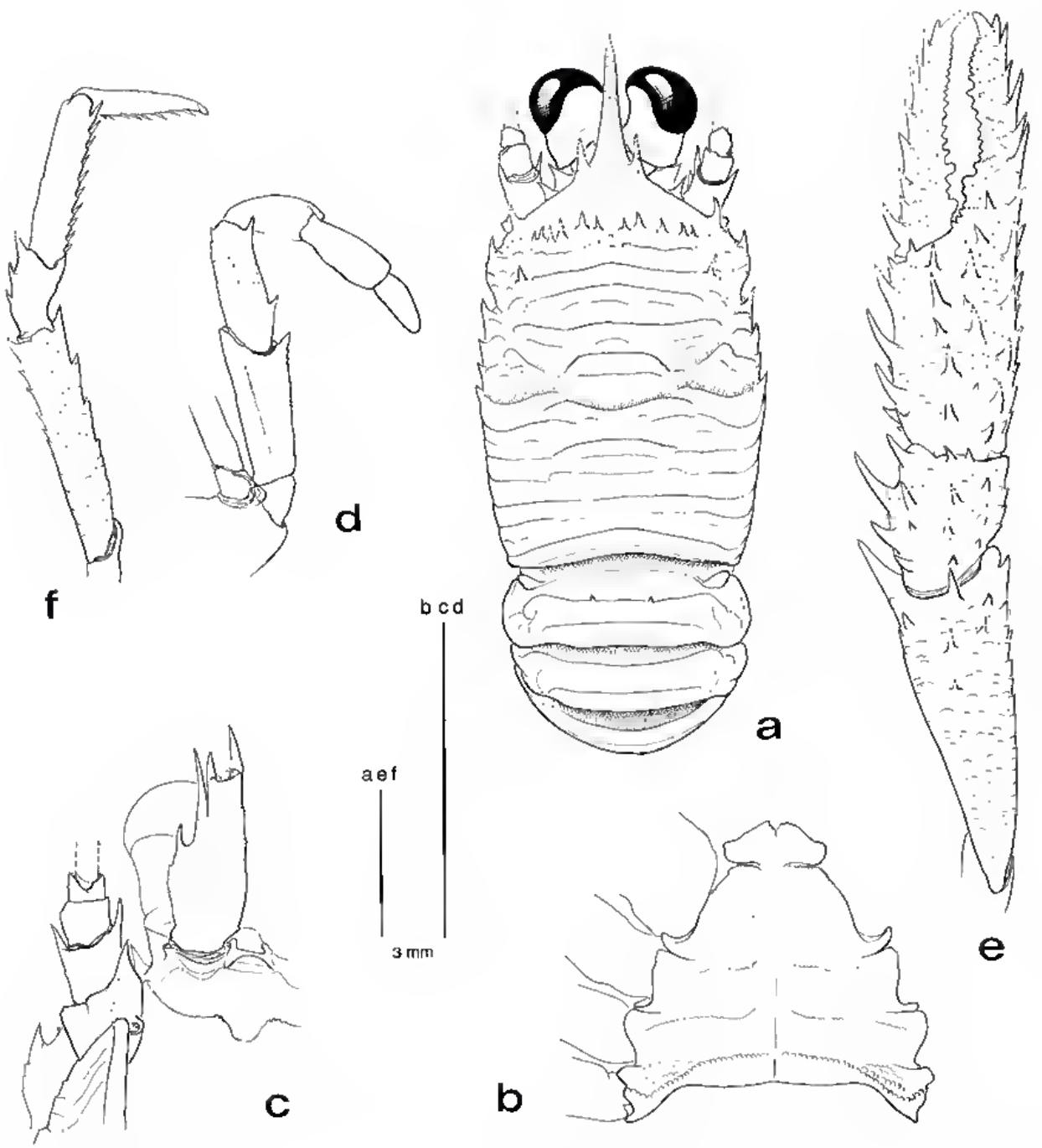


FIG. 13. — *Munida evarne* sp. nov., holotype, male 6 mm (MNHN Ga 1908) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

ETYMOLOGY. — The name refers to one of the Nereids of the Greek mythology (Evame).

DIAGNOSIS. — Carapace dorsally armed with 11 epigastric spines ; parahepatic spines present. Frontal margins strongly oblique. Rostrum straight. Supraocular spines not reaching to midlength of rostrum and to end of corneas. Branchial margins with four spines. Thoracic sternites without marked carinae, lateral surface of seventh stemite with some granules. Second abdominal tergite with two small spines and one transverse stria. Eyes large. Distomesial spine of antennular basal segment longer than lateral. Distal spine of basal segment of antennal peduncle overreaching second segment. Merus of third maxilliped with two ventral marginal spines, dorsal margin unarmed. Chelipeds and walking legs lacking epipods. Cheliped fingers armed with spines along dorso-lateral and mesial margins. Dactylus of walking legs about 3/4 propodus length.

DESCRIPTION (holotype)

Carapace slightly longer than wide. Transverse ridges with dense, short setae and some long iridescent setae. Main transverse striae on posterior part of carapace interrupted in cardiac region. Secondary striae almost absent on branchial regions. Gastric region with one row of 11 epigastric spines, largest pair just behind supraocular spines. One parahepatic spine on each side. Remaining parts of carapace unarmed.

Frontal margins strongly oblique. Lateral margins slightly convex. First anterolateral spine short, clearly not reaching to sinus between rostrum and supraocular spines. Second spine somewhat smaller, preceded by one small spinule. Branchial margins with four spines, first one well developed, others reduced.

Rostrum straight, horizontal, much shorter than remaining carapace. Supraocular spines short, clearly not reaching to midlength of rostrum and to end of corneas, subparallel, upwardly directed.

Fourth thoracic sternite smooth, devoid of striae. Transverse ridges between fifth, sixth and seventh sternites obtuse, slightly granulated ; lateral parts of seventh sternite with numerous coarse granules.

Second abdominal tergite with one median pair of small spines. Second and third abdominal tergites each with one transverse continuous stria. Fourth and fifth tergites smooth.

Eyes large, maximum corneal diameter more than 1/3 length of anterior border of carapace between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) 1/4 carapace length, elongate, slightly reaching beyond corneas, with two distal spines, mesial longer than lateral ; and two spines on lateral margin, proximal short, located at midlength of segment, distal long, overreaching distolateral but not distomesial spine.

First segment of antennal peduncle with one short distomesial spine nearly, reaching to the end of second segment ; second segment with two distal spines, mesial spine longer than lateral spine ; penultimate segment unarmed.

Ischium of third maxilliped *c.* 1.5 times length of merus, distoventrally bearing spine. Merus with two small spines of subequal sizes on flexor margin (distal one absent in left appendage). Extensor margin unarmed.

Chelipeds subequal, slightly gaping, with numerous setae scattered on mesial and dorsal borders of articles. Right cheliped 2.5 times carapace length. Merus slightly shorter than carapace, twice as long as carpus and 1.5 times longer than palm ; palm 1.5 times longer than

Source : MNHN, Paris

high and nearly as long as fingers. Merus armed with several spines on dorsal, mesial and ventral sides. Carpus with several spines scattered on dorsal, mesial and ventral borders. Palm with several strong spines scattered on mesial and dorsal sides and one row of dorsolateral spines, continuing along fixed finger, reaching tip. Fingers distally curving and crossing, ending in a sharp point. Movable finger with one row of spines along mesial margin, reaching tip. Cutting edges with small teeth of various sizes.

Walking legs slender, furnished with long, plumose, iridescent setae on dorsal margins and some scattered setae on lateral borders. Second pereiopod nearly twice as long as carapace. Merus slightly shorter than carapace length, 5 times as long as high, *c.* 3 times carpus length and 1.5 times as long as propodus ; propodus *c.* 5 times as long as high and slightly longer than dactylus. Merus with a dorsal row of ten small spines, increasing in size distally, one long distoventral spine and two projecting striae on distal half of ventral margin. Carpus with long dorsal and ventral distal spines, and 2-3 additional spines on dorsal margin. Propodus with one row of 10-11 movable ventral spines. Dactylus with dorsal margin slightly convex on proximal half, slightly curving distally, with 7-9 movable ventral spinules. Third pereiopod similar to second. Fourth pereiopod shorter than second and third and less spinulated. Merus of fourth pereiopod about half as long as that of second pereiopod. Epipods absent from all pereiopods.

REMARKS. — *Munida evarne* resembles *M. pasithea* sp. nov., but they differ in the following characters :

— the frontal border of the carapace is clearly more oblique in *M. evarne* ;

— in *M. evarne* the distomesial spine of the basal segment of the antennular peduncle is longer than the distolateral spine, whereas in *M. pasithea* the distal spines are subequal ;

— the lateral parts of the 7th thoracic sternite are ornamented with only a few coarse granulations in *M. evarne*, whereas in *M. pasithea* the granules are more numerous and cover the lateral parts of the 6th and 7th sternites ;

— the spines on the flexor margin of the merus of the 3rd maxillipeds are much stronger in *M. pasithea.*

DISTRIBUTION. — Tubuai (NW Rapa) Islands, 100-300 m depth.

14. **Munida pasithea** sp. nov.
(Fig. 14)

MATERIAL EXAMINED. — **Tubuai Islands**, 03.1978, 300 m, dredge : 1 ♂ 5.5 mm (holotype, MNHN Ga 1905).

ETYMOLOGY. — The name refers to one of the Nereids of the Greek mythology (Pasithea).

DIAGNOSIS. — Carapace dorsally armed with five pairs of epigastric spines ; parahepatic and postcervical spines present. Frontal margins slightly oblique. Rostrum straight. Supraocular spines not reaching to midlength of rostrum and to end of corneas. Branchial margins with four spines. Thoracic sternites without marked carinae, lateral surface of sixth and seventh sternites with many small granules. Second abdominal tergite with four pairs of spines and one transverse stria. Eyes large. Distal spines of antennular basal segment subequal in size. Distal spine of basal segment of antennal peduncle slightly

Source : MNHN, Paris

overreaching second segment. Merus of third maxilliped with two spines on flexor margin ; extensor margin unarmed. Chelipeds and walking legs squamous, lacking epipods. Chelipeds fingers armed with one row of spines along dorsolateral and mesial borders. Dactylus of walking legs slightly shorter than propodus.

DESCRIPTION

Carapace slightly longer than wide. Transverse ridges mostly not interrupted, without setae. Main transverse striae on posterior part of carapace interrupted in cardiac region. Secondary striae absent. Gastric region with one row of five pairs of epigastric spines, largest pair just behind supraocular spines. One parahepatic and postcervical spine on each side.

Frontal margins clearly oblique. Lateral margins almost straight. Anterolateral spine situated at anterolateral angle, not reaching to the level of sinus between rostrum and supraocular spines. Second spine before cervical groove somewhat smaller than preceding. Branchial margins with four spines decreasing in size posteriorly.

Rostrum straight and horizontal, *c.* half as long as remaining carapace. Supraocular spines not reaching to midlength of rostrum, and end of corneas, slightly convergent and slightly directed upwards.

Fourth thoracic sternite with several arcuate striae. Lateral parts of sixth and seventh sternites with numerous small granules. Transverse ridges between fifth, sixth and seventh sternites obtuse, slightly granulated.

Second abdominal tergite with one row of four pairs of spines on anterior border. Second and third abdominal tergites with one transverse continuous stria. Fourth and fifth tergites smooth.

Eyes large, maximum corneal diameter about 1/3 the distance between bases of anterolateral spines.

Basal segment of antennule (distal spines excluded) slightly less than one-half carapace length, elongate, reaching beyond corneas, with two subequal, short, distal spines ; and two lateral spines, proximal one short, located at midlength of segment, distolateral one long, almost reaching distal spines.

First segment of antennal peduncle with one strong spine on mesial margin, slightly overreaching second segment ; second segment with two long distal spines, overreaching penultimate segment ; penultimate segment unarmed.

Ischium of third maxilliped slightly more than 1.5 times length of merus measured along extensor margin, distoventrally bearing spine. Merus bearing two spines on flexor margin, distal one smaller. Extensor margin unarmed.

Right cheliped (left is missing) squamous, with numerous iridescent setae, more dense on mesial borders of articles. Cheliped *c.* 3 times carapace length. Merus as long as carapace, twice longer than carpus and slightly less than twice longer than palm ; palm 2.5 times as long as high and slightly shorter than fingers. Merus armed with four rows of spines. Carpus with one row of spines on mesial margin and several spines scattered on dorsal and lateral sides. Palm with several spines scattered on mesial and dorsal sides and one row of dorsolateral spines, continuing along fixed finger, reaching tip. Movable finger with one row of spines along mesial border, reaching tip. Fingers distally curving and crossing, ending in sharp point. Cutting edges with small teeth of different sizes.

Source : MNHN, Paris

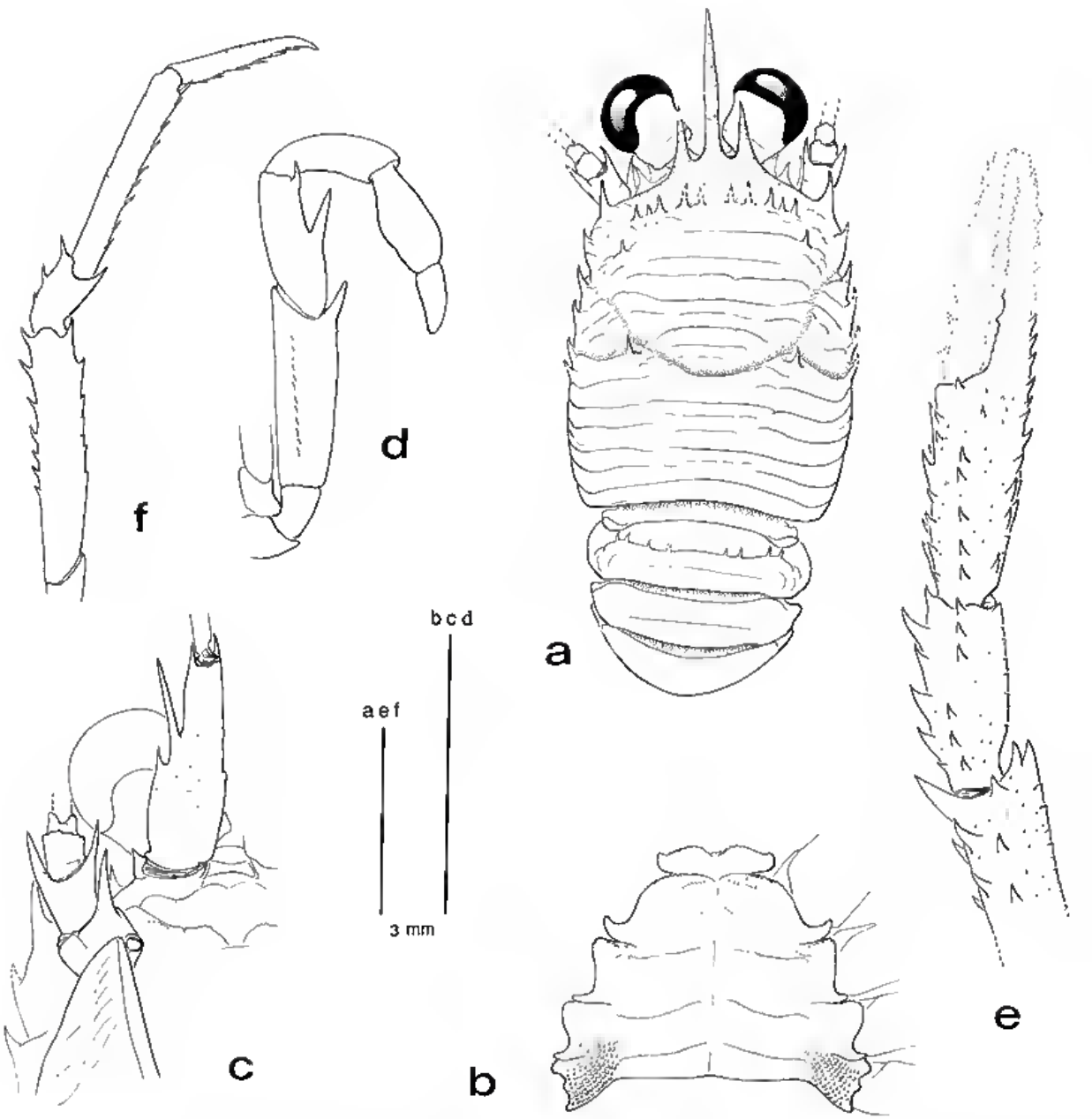


FIG. 14. — *Munida pasithea* sp. nov., holotype, male 5.5 mm (MNHN Ga 1905) : a, carapace, dorsal view ; b, sternal plastron ; c, ventral view of cephalic region, showing antennula and antenna peduncles ; d, right third maxilliped, lateral view ; e, right cheliped, dorsal view ; f, right second pereiopod, lateral view.

Source : MNHN, Paris

Walking legs slender, furnished with long, plumose, not iridescent setae on dorsal margins and some short setae scattered on lateral borders. Merus of second pereiopods slightly shorter than carapace length, more than 6 times as long as high, 3.5 times carpus length and *c.* 1.5 times as long as propodus ; propodus more than 6 times as long as high. Dactylus of second pereiopod broken, that of third pereiopod elongate, slightly shorter than propodus. Merus with one dorsal row of eight spines, one long distoventral spine and one projecting stria on distal half of ventral margin. Carpus with one long distal spine, three additional spines on dorsal margin and one distal spine on ventral margin. Propodus with one row of nine movable ventral spines. Dactylus of third pereiopod elongate, dorsal margin straight, slightly curving distally, with six movable ventral spinules. Third pereiopod similar to second. Fourth pereiopod shorter than second and third and less spinulated. Merus of fourth pereiopod *c.* 3/4 as long as that of second pereiopod. Epipods absent from all pereiopods.

REMARKS. — Unfortunatly the cheliped of the holotype was broken after it was studied, but before it could be illustrated. Therefore, the figure given here is a partial reconstruction from the description.

Munida pasithea is closely related to *Munida evarne* sp. nov., however they are easily distinguishable by several characters (see remarks under *M. evarne*).

The new species is also close to *Munida albiapicula* Baba and Yu, 1987, from Taiwan (BABA and YU, 1987 ; BABA, 1988), but both species can be distinguished by the following characters :

— the supraocular spines are very short, not reaching to the middle of rostrum or to end of corneas in the new species ; these spines are much longer in *M. albiapicula*, distinctly over reaching midlength of the rostrum ;

— the spines of the antennal peduncle are shorter in *M. pasithea* (*cf.* fig. 14c and BABA and YU, 1987, fig. 2c).

DISTRIBUTION. — Tubuai Islands, 300 m depth.

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Source : MNHN, Paris

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Source : MNHN, Paris

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section A, nos 3-4 : 423-428.

Hypocolpus mararae, espèce nouvelle de Polynésie française (Crustacea Decapoda Brachyura Xanthidae)

par Alain CROSNIER

Résumé. — Des pêches faites au casier par 130-150 m de profondeur, en Polynésie française, ont permis de capturer trois spécimens d'*Hypocolpus* appartenant à une espèce nouvelle, *H. mararae*, qui est décrite ici.

Abstract. — Fishing with baited traps in French Polynesia at depths of 130-150 m has resulted in the capture of 3 specimens of *Hypocolpus* belonging to a new species, *H. mararae*, which is described in this paper.

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Le Service Mixte de Contrôle Biologique des Armées (SMCB) a pour vocation de dresser l'inventaire de la faune et de la flore des archipels de la Polynésie française et de suivre leur évolution, notamment au plan de la radiocontamination.

Le « Marara », chalutier de 43 mètres, est un des moyens d'action du SMCB. Depuis 1975, et plus intensivement depuis 1985 sous la conduite de M. Joseph POUPIN, ce navire effectue des pêches au casier qui ont permis des récoltes d'une grande richesse.

Parmi ces récoltes, trois spécimens appartiennent á une espèce nouvelle d'*Hypocolpus* que nous décrivons ci-après.

Hypocolpus mararae sp. nov.

(Fig. 1 ; pl. I)

MATÉRIEL EXAMINÉ. — **Iles de la Société**. Récoltes SMCB (J. POUPIN) : st. 263, Raiatea, 16°43,7' S-151°25,4' W, casier, 130 m, 21.06.1990 : 1 ♀ 20,3 × 31,2 mm (MNHN-B 22174). — **Archipel des Tuamotu**. Récoltes SMCB (J. POUPIN) : st. 243, Marutea sud, 21°30,8' S-135°38,5' W, 130 m, 30.05.1990 : 1 ♀ 28,2 × 43,2 mm (MNHN-B 22175); st. 334, Tureia, 20°46,7' S-138°34,6' W, casier 150 m, 29.10.1990 : 1 ♂ 15,9 × 23,9 mm (MNHN-B 22176).

TYPES. — La femelle récoltée à la station 243 (MNHN-B 22175) est l'holotype. L'autre femelle et le mâle sont des paratypes.

Source : MNHN, Paris

DESCRIPTION

La carapace est beaucoup plus large que longue (rapport longueur/largeur = 1,50 chez les deux femelles et 1,53 chez le mâle). Elle ne porte que de rares soies (à moins que celles-ci n'aient été brossées lors de la capture, ce que nous ne pensons pas). Elle présente des lobules très bombés, au relief mouvementé, formés d'amas irréguliers de granules dont seuls ceux des sommets sont bien distincts. Ces lobules sont séparés par de profonds sillons, presque toujours dépourvus de granules. Lobules et sillons sont parsemés de petits trous. La disposition des lobules est celle du schéma classique de DANA (1852), à l'exception de 2M qui est divisé longitudinalement sur toute sa longueur.

Le front, peu saillant, présente deux lobes médians peu proéminents, reliés aux orbites par une faible concavité.

Le bord antérolatéral de la carapace, jusqu'au sillon séparant les lobules 3L et 4L, est formé par le bord supérieur de la cavité sous-hépatique qui a l'aspect d'un bourrelet largement saillant, à bord lisse et très faiblement convexe. En arrière, le bord antérolatéral est formé de granules ou d'amas de granules saillants, la jonction de ce bord et du bord postérolatéral étant marqué par un gros amas de granules d'aspect dentiforme.

Le bord postérolatéral est fortement concave, avec un angle marqué. Il est bordé de granules et d'amas de granules. Il reçoit le mérus et le bord supérieur du carpe de la cinquième patte, lorsque celle-ci est repliée. L'angle correspond à l'extrémité distale du mérus de cet e patte.

Le bord postérieur, très légèrement sinueux, est bordé d'une ligne irrégulière d'amas de granules, doublée d'une ligne de granules.

La cavité sous-hépatique, lisse, est de grande taille, vaguement ovalaire, et s'étire transversalement. Ses bords supérieur et interne sont fortement saillants, en forme d'auvent recourbé. Le bord inférieur n'est au contraire marqué que par un faible bourrelet. Le bord supérieur est presque droit dans sa partie médiane et s'incurve dans ses parties distales. Le bord inférieur est convexe et plus fortement incurvé du côté interne que du côté externe. De haut en bas (fig. 1 a), cette cavité présente : une dépression longitudinale qui borde le bord supérieur; une côte large et basse, arrondie et symétrique en coupe transversale; une dépression longitudinale; une autre côte plus étroite que la précédente, très dissymétrique en coupe transversale, sa face supérieure étant abrupte; enfin, une dépression faible bordant le bord inférieur de la cavité.

La face ventrale du corps est couverte de tubercules arrondis.

Toutes les parties des péréiopodes et des chélipèdes ne se recouvrant pas entre elles, ont un relief très tourmenté, voisin de ce qui a été figuré par GUINOT-DUMORTIER (1960, pl. 5) pour *H. rugosus* (Henderson, 1893), formé de nodosités granuleuses et de granules dentiformes ou arrondis, parfois disposés plus ou moins en ligne (sur la face externe du propode des chélipèdes en particulier, pl. I D). L'ischion et le mérus des chélipèdes sont soudés, mais la ligne de suture entre les deux articles demeure bien visible sur les faces inférieure et antérieure de l'ischio-mérus. Les doigts des chélipèdes sont brun-noir, la coloration foncée ne s'étendant pas, en arrière du doigt fixe, sur la face externe du propode.

L'abdomen, dont les segments 3-5 sont soudés chez le mâle, porte sur les segments 2-6 un fort renflement transversal médian, plutôt lisse, creusé par un sillon transversal qui peut

Source : MNHN, Paris

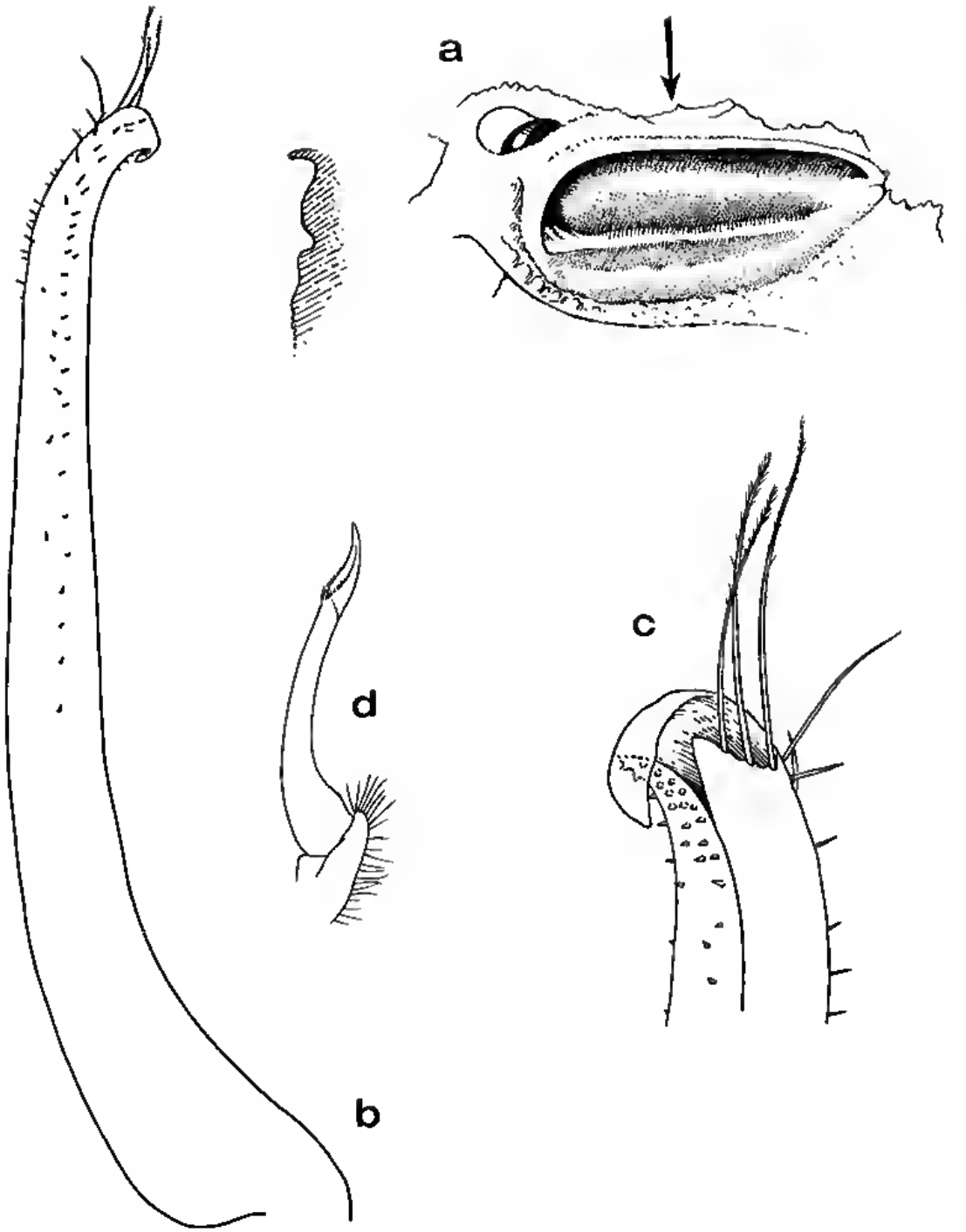
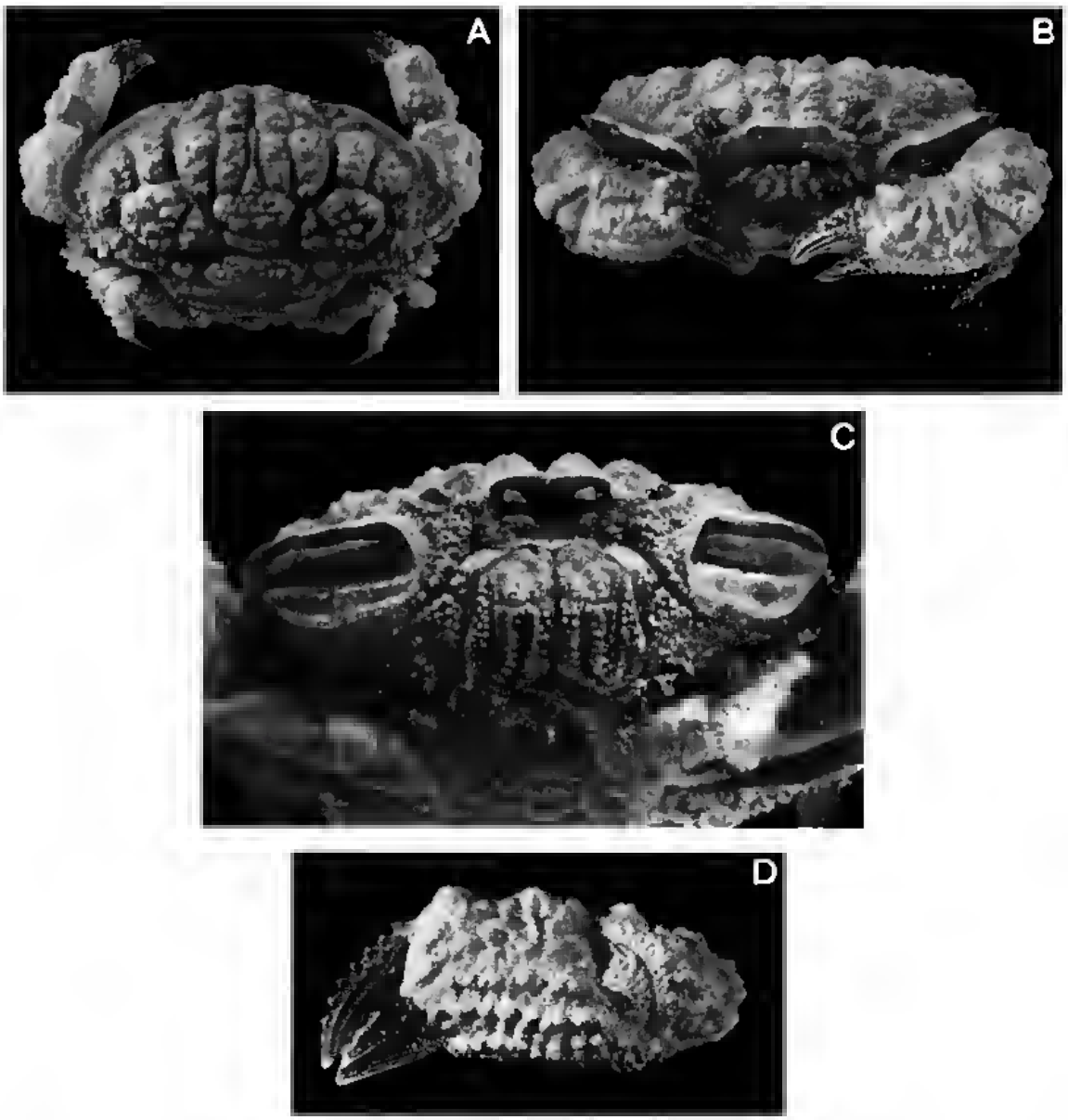


FIG. 1. — *Hypocolpus mararae* sp. nov., ♂ paratype, 15,9 × 23,9 mm, archipel des Tuamotu (MNHN-B 22176) : a, cavité sous-hépatique gauche, vue d'ensemble et section transversale (à l'emplacement de la flèche) ; b, pléopode 1 droit, vue dorsale ; c, *idem*, vue ventrale de la partie distale ; d, pléopode 2 droit, vue latérale externe.

Source : MNHN, Paris



Pl. I — *Hypocolpus mararae* sp. nov., a et d : ♀ paratype, 20,3 × 31,2 mm, îles de la Société (MNHN-B 22174) : a, animal entier, vue dorsale ; d, carpe et propode du chélipède gauche. — b-c : ♀ holotype, 28,2 × 43,2 mm, archipel des Tuamotu (MNHN-B 22175) : b, animal entier, vue de face ; c, corps, vue oblique montrant les cavités sous-hépatiques.

Source : MNHN, Paris

partager partiellement (segment 2-4) ou entièrement (segment 5-6) le renflement ; renflements et sillons sont creusés de trous. Sur les segments 1 et 7, le renflement est beaucoup plus irrégulier et sans sillon. Les segments 1 et 7, de même que les bords latéraux des autres, portent de forts granules.

Le pléopode 1 du mâle est tout à fait conforme à celui des autres espèces du genre (fig. 1 b-c) : sa pointe distale se recourbe fortement ; trois longues soies plumeuses, subdistales, sont observées (un seul mâle examiné). Le pléopode 2 (fig.1 d) est également du type habituel.

ÉTYMOLOGIE. — L'espèce est dédiée au navire « Marara » qui est utilisé, depuis de nombreuses années par le SMCB, pour effectuer les récoltes qui sont envoyées régulièrement au Muséum.

REMARQUES

Jusqu'à maintenant dix espèces d'*Hypocolpus* avaient été décrites. Huit d'entre elles ont été étudiées en détail par GUINOT-DUMORTIER (1960). SERÈNE (1984 : 77) en passe en revue neuf. La dixième, *H. pardii*, a été décrite tout récemment par VANNINI & GALIL (1990).

H. mararae ne peut être confondu avec aucun des autres *Hypocolpus*, en raison de sa cavité sous-hépatique bien particulière. La seule espèce qui présente une cavité sous-hépatique dont la forme est proche de celle de *H. mararae*, est *H. abbotti* Rathbun, 1894. Mais, chez cette espèce, la cavité sous-hépatique est divisée en trois par deux côtes longitudinales étroites et très en relief, qui sont entièrement différentes de celles, plutôt mal définies et s'apparentant à de simples renflements longitudinaux, caractéristiques de *H. mararae*.

Par ailleurs, *H. abbotti* se sépare de *H. mararae* par :

— la présence de très nombreuses soies sur la carapace,

— le relief moins tourmenté et la granulation mieux marquée des nodosités de la face dorsale de la carapace,

— le bord supérieur de la cavité sous-hépatique granuleux,

— les faces externes des péréiopodes granuleuses mais sans fortes nodosités,

— le premier pléopode mâle portant des soies plumeuses subdistales plus nombreuses (une dizaine au lieu de trois).

La littérature est assez pauvre en ce qui concerne la répartition bathymétrique des *Hypocolpus*. GUINOT-DUMORTIER (1960) ne fournit aucun renseignement sur ce point. En fait, il semble bien que les espèces décrites jusqu'à maintenant aient toutes été récoltées dans la zone intertidale ou à faible profondeur et surtout en zone récifale. SAKAI (1976) mentionne que *H. granulatus* (de Haan, 1837) peut être trouvé depuis la côte jusqu'à 30 mètres de profondeur ; c'est la plus grande profondeur que nous ayons vu mentionnée pour le genre. Les profondeurs (130 à 150 m) auxquelles *H. mararae* a été capturé, sont donc inattendues.

Les captures de *H. mararae* étendent par ailleurs, considérablement, l'aire de répartition du genre. Celui-ci, en effet, n'était pas connu dans le Pacifique, à l'est de l'île Thursday (10°37′ S-142°10′ E) où a été capturé le type de *H. punctatus* (Miers, 1884).

Source : MNHN, Paris

Remerciements

Mr J. POUPIN, chef des opérations à bord du « Marara », nous a remis le matériel étudié ici. Le Dr D. GUINOT a bien voulu critiquer notre manuscrit. MM. D. SERRETTE et J. REBIÈRE sont les auteurs des photos et Mr M. GAILLARD, celui des dessins. A tous nous adressons nos remerciements.

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Source : MNHN, Paris

Bull. Mus. natl. Hist. nat., Paris, 4e sér., 13, 1991,
section A, nos 3-4 : 429-437.

Euphrosynoplax campechiensis, new species (Crustacea, Decapoda, Brachyura, Goneplacidae), from the continental shelf of the Southwestern Gulf of Mexico

by Ana R. VÁZQUEZ-BADER and Adolfo GRACIA

Abstract. — During trawl sampling activities on the continental shelf of the southwestern Gulf of Mexico, a new species of *Euphrosynoplax* Guinot was found ar six different localities. This second species of *Euphrosynoplax, E. campechiensis* sp. nov., is compared with the only known species *E. clausa* Guinot, originated from the Gulf of Mexico.

Résumé. — Des chalutages le long de la plate-forme continentale du golfe du Mexique ont permis de récolter dans six localités distinctes une nouvelle espèce du genre *Euphrosynoplax* Guinot, *E. campechiensis* sp. nov. Cette deuxième espèce de *Euphrosynoplax* est comparée avec l'unique espèce *E. clausa* Guinot, également originaire du golfe du Mexique

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During sampling activities on the continental shelf of the southwestern Gulf of Mexico aboard the research vessel "Justo Sierra" of the Universidad Nacional Autónoma de Mexico (PROGMEX 1, 2 and 3 cruises), several specimens of goneplacid-like brachyuran crabs were collected using a semicommercial otter-trawl. These specimens were first identified as *Euphrosynoplax* Guinot. A later examination of these demonstrated that they belonged to an undescribed species of *Euphrosynoplax*. The description of this new species is presented here and compared with *E. clausa*.

The holotype is deposited at the Secretaria de Marina Investigaciones Oceanográficas (SMIOM) collection and paratypes are deposited at the Muséum national d'Histoire naturelle Paris (MP) and Instituto de Biologia Universidad Nacional Autónoma de Mexico (EM).

Euphrosynoplax campechiensis sp. nov.
(Fig. 1 a; 2 a; 3 a; 4 a; Pl. I A-C)

MATERIAL EXAMINED. — PROGMEX1 cruise, station 28, March, 1983; 19°04.4' N-92°43.2' W, off S. Pedro and S. Pablo rivers, Campeche, 85 m depth : 1 ♂ holotype 29.2 × 41.2 mm (SMIOM-01664); 1 ♂ paratype 29 × 42 mm (SMIOM-01665); 1 ♂ paratype 30 × 47.3 mm (EM-10734); 1 ♂ paratype 29.6 × 41.6 mm (MP-B 22313) — station 32B, April, 1983; 19°22.1' N-92°32.5' W off Términos Lagoon,

Source : MNHN, Paris

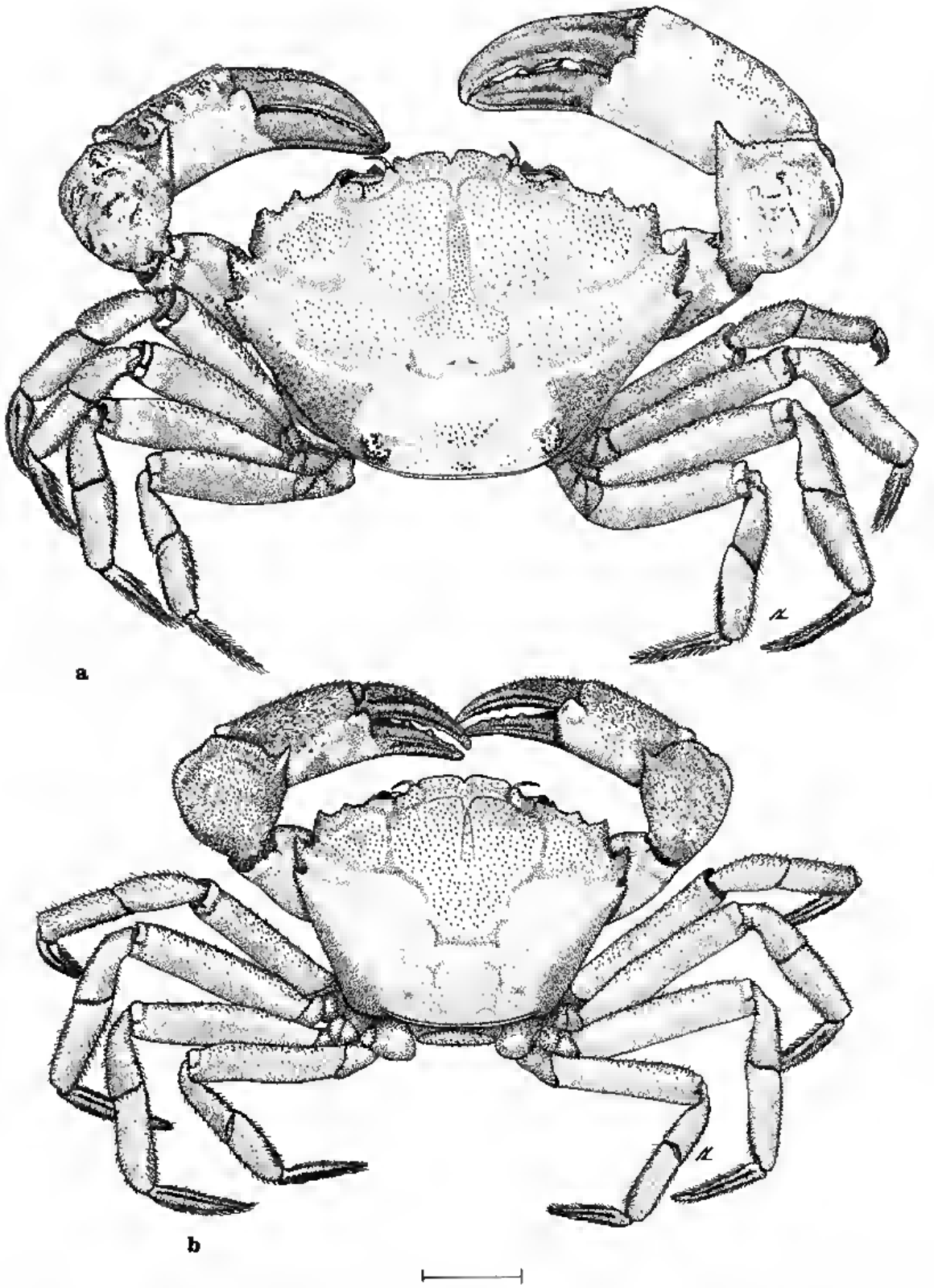

FIG. 1. — a : *Euphrosynoplax campechiensis* sp. nov., ♂ holotype (SMIOM 01664), dorsal view of carapace and appendices (external fissures not visible) ; b : *Euphrosynoplax clausa* Guinot, ♂ (PROGMEX2 E·22), dorsal view of carapace and appendices. Scale a-b : 1 cm.

Source : MNHN, Paris

Campeche, 113 m depth : 1 ♂ 26.7 × 36.4 (SMIOM-01666) — PROGMEX2 cruise, station 45X, April, 1984; 21°27.3' N-92°25.3' W, off Champotón river, Campeche, 158 m depth : 1 ♂ 13.4 × 18 mm (SMIOM-01667) — PROGMEX3 cruise, station 9, August, 1984; 18°46.4' N-94°59.7' W, off Pta. Zapotitlán, Veracruz, 88 m depth : 1 ♂ 17.4 × 24 mm (SMIOM-01668) — station 38, August, 1984; 19°28.8' N-91°57.6' W, off Terminos Lagoon, Campeche, 47 m depth : 1 ♀ allotype 17.6 × 25.4 mm (SMIOM-1669) — station 42, August, 1984; 19°59.9' N-92°04.1' W, 108 m depth : 1 ♂ 26.7 × 38 mm (SMIOM-01670).

Description

Carapace hexagonal, xanthoid, broader than long, aerolation evident. Surface granulated, pubescent, densest granulation on anterolateral border, teeth and front. Regions fairly marked; hepatic regions elevated and strongly granulated. Carapace widest at level of fourth anterolateral tooth. Front narrow, moderately convex, divided in half by prominent notch, each half bilobed; inner lobe sinuate, broad; outer lobe forming a conspicuous tooth.

Orbits small and deep, eyestalk short, broad and granulated; upper orbital border with two fissures; suborbital border with acute inner tooth; outer orbital tooth wanting.

First tooth of anterolateral border, small, almost conical; second tooth close to first, much larger, triangular, subacute; both first and second teeth on a level with upper orbital margin. Third tooth largest, acuted, directed obliquely forward and a little upward, separated from second by a distance much greater than that separating second from first; last tooth smaller than third and directed outward.

Antero-external angle of merus of third maxilliped strongly produced. Ischium with inner orange spot.

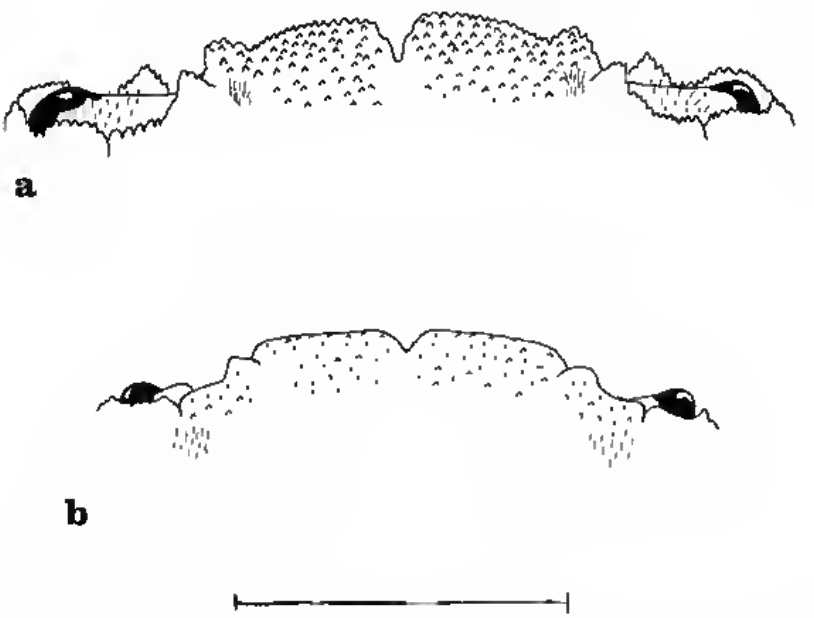

Fig. 2. — a : *Euphrosynoplax campechensis* sp. nov., ♂ holotype (SMIOM 01664), dorsal view of front and orbits (antennal articles omitted); b : *Euphrosynoplax clausa* Guinot, ♂ (PROGMEX2 E-22), dorsal view of front and orbits (antennal articles omitted). Scale a-b : 1 cm.

Source : MNHN, Paris

Chellipeds massive, granulated, unequal. Larger chela with conspicuous granules on external surface and with ridge of tubercles on superior border; minor chela with fairly strong ridge of tubercles on superior border more prominent than major chela. Carpus with stout and acute inner spine, inner margin indented; merus toothed on superior border. Inner side of palm inflated, smooth except borders which are conspicuously granulated; fingers long, pointed, with two sulcis on external surface, more evident in minor chela, slightly incurving, irregularly toothed with 2 or 3 strong projecting teeth.

Pereiopods slender; slightly flattened, granulated, superior border of merus dented. Pubescence well defined on carpus, propodus and dactyl, not very evident on carpus; dactyl slightly curved.

Male abdomen strongly granulated, first and second somites not reaching coxa of fifth pereiopod at each side; small portion of sternite eight visible between second and third abdominal somites; third of fifth somites fused. Sixth somite wider than long, sides concave; seventh somite (telson) triangular, sides straight, tip rounded.

Male opening coxal. First pleopod long, slender, curved and with several strong subterminal spinules in addition to marginal spinules on distal part; opening terminal flanked by a large subrectangular protective lobe. Second pleopod stout, curved and ending in falciform process pubescent at base.

The only female available is similar in shape to carapace, front, and anterolateral, and posterolateral margins of male. Chelipeds of female unequal, more pubescent, spacially minor chela, similar in shape to chelipeds of male. Abdomen narrow, all segments free, seventh segment (telson) triangular; sternum finely granulated and pubescent. Gonopores almost rounded, and shallow.

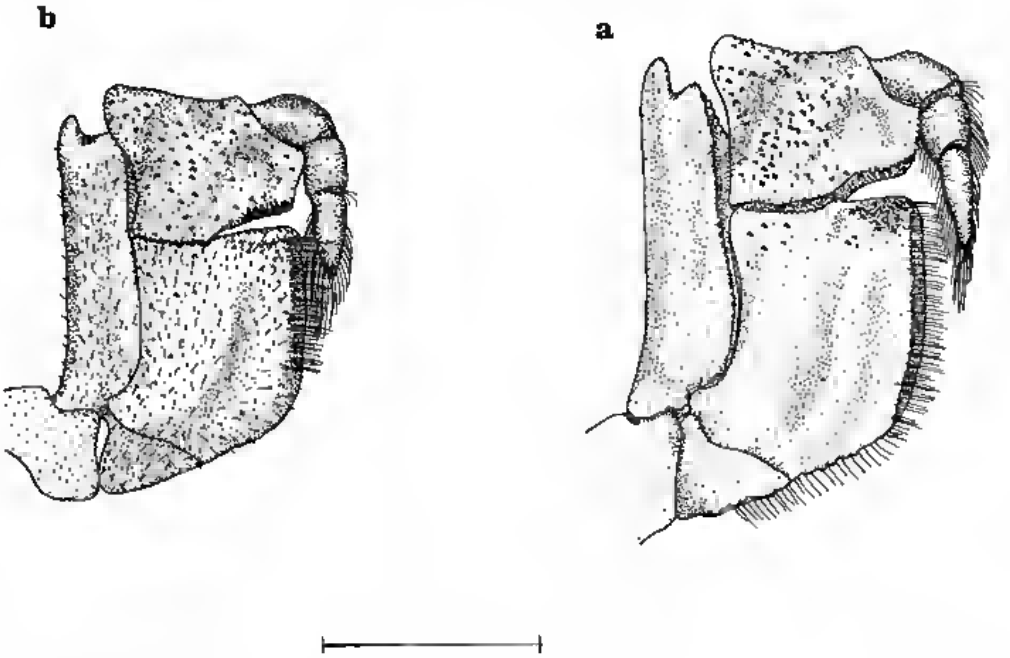

FIG. 3. — a : *Euphrosynopolax campechiensis* sp. nov., ♂ holotype (SMIOM 01664), abdomen; b : *Euphrosynoplax clausa* Guinot, ♂ (PROGMEX2 E-22), abdomen. Scale a-b : 5mm.

Source : MNHN, Paris

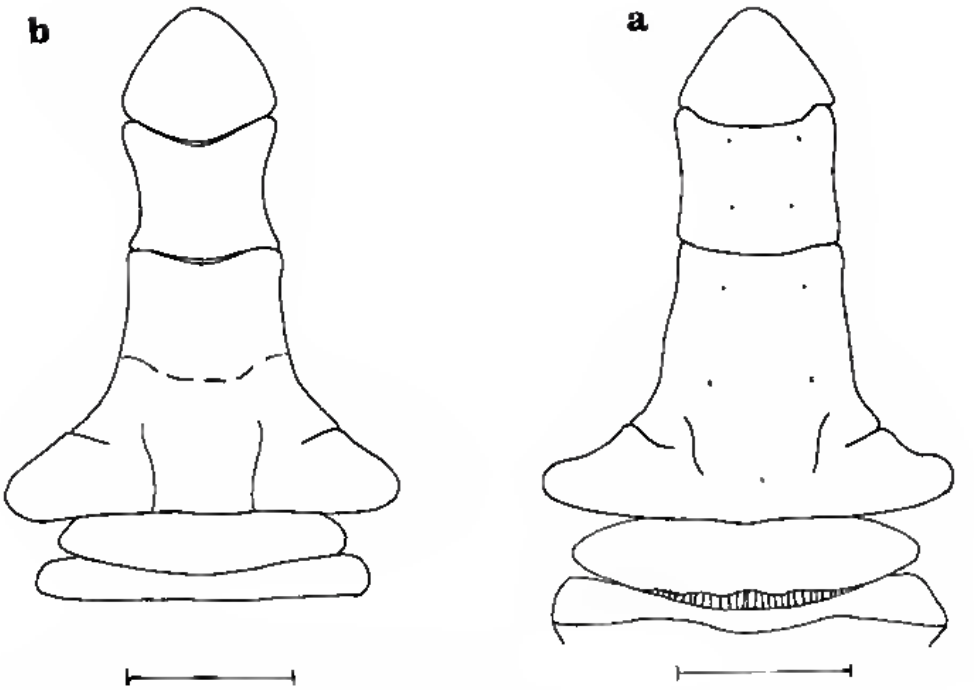

FIG. 4. — a : *Euphrosynoplax campechuensis* sp. nov., ♂ holotype (SMIOM 01664), third maxilliped; b : *Euphrosynoplax clausa* Guinot, ♂ (PROGMEX2 E-22), third maxilliped. Scale a-b : 5 mm.

In the smallest organisms the front is not advanced, the external tooth is not conspicuous; the minor chela is more tuberculated and the crest of dactyl is more evident.

Colour : This new species is orange-brown, except for the finger of the chelae which are black; some specimens, mainly the smallest ones have little orange spots on carapace.

ETYMOLOGY. — *E. campechiensis* is named after the Bank of Campeche where it was collected.

DISTRIBUTION. — Found in the Gulf of Mexico, on the continental shelves of Veracruz and Campeche, México.

REMARKS

The type material of *Euphrosynoplax campechiensis* was compared with specimens of *E. clausa* collected during the cruises PROGMEX1, 2 and 3 with the description of GUINOT (1969*b* : 720; figs 127a, b; 139; pl. IV (*recte* V), fig. 3). A comparison with the paratype held at the Muséum national d'Histoire naturelle, Paris (MP-B 10153, ex USMN 65938) was kindly done by Dr. GUINOT.

This new species differs from the only other species of the genus *E. clausa* by several characteristics (table 1). The most evident are : front bilobated with external conspicuous

Source : MNHN, Paris

TABLE 1. - Main differences between *Euphrosynoplax campechiensis* and *E. clausa* Guinot.

	E. campechiensis	*E. clausa*
CARAPACE	Regions well marked Front bilobed, indented with deep notch; with a conspicuous external tooth Anterolateral margin long Hepatic region with a protuberance	Regions little marked Front bilobed, smooth with shallow notch; without external teeth Anterolateral margin short Hepatic region without protuberance
ORBIT	Orbits large, deep Eyestalks large, pubescent Suborbital tooth conical, acuted, indented Inner orbital tooth stout, well defined	Orbits small, shallow Eyestalks short Suborbital tooth obtusely triangular Inner orbital tooth reduced
CHELIPED	Minor chela with carpus rugose, superior border of propodus with tubercles	Minor chela with carpus smooth; propodus granulated
ABDOMEN (male) (female)	Sixth segment longer then wide, sides concave Seventh segment triangular, sides almost straight Abdomen narrow; seventh segment triangular	Sixth segment almost longer than wide, sides strongly concave Seventh segment semioval, sides slightly convex Abdomen wide; seventh segment rounded
FIRST PLEOPOD	Slender; opening with a larger protective subrectangular lobe, without proximal process	Opening with a short protective, subconical lobe with a large proximal process

tooth; male abdomen terminating in a triangular somite; the male first pleopod more deflexed and with a subrectangular protective lobe in the new species. In dorsal view, the new species differs from *E. clausa* in that the carapace has the regions well marked, the front has a deep nocht, and the orbits are small and deep. The anterolateral margin is also slightly larger than *E. clausa*. In *E. campechiensis* the carapace length is about to 1.54 to 1.91 times the large anterolateral margin, while in *E. clausa* (calculated from material examined at PROGMEX 1, 2 and 3 cruises) it is 1.93 to 2.26.

With respect to the habitat, *E. clausa* has been collected between 91-210 m (PEQUEGNAT, 1970; POWERS, 1977), but in PROGMEX 1, 2 and 3 cruises it was taken on 47 to 171 m, while *E. campechiensis* was found in a bathimetric range of 85 to 158 m. Environmental data indicate that the new species is associated with muddy bottom (VÁZQUEZ-BADER and GRACIA *in press*). As stated by GUINOT (1969*b* : 720), *Euphrosynoplax* presents a catometopus organization, with the male opening coxal but a small portion of sternite 8 not covered by the second abdominal somite ("apparaît comme un Catométope tout à fait primitif"); see GUINOT, 1969*a* : 244.

Acknowledgements

We sincerely thank Dr. GUINOT for reviewing the manuscript and for comparing the specimens with the paratype held at the Paris Museum. We also thank M. C. Jorge Luis HERNANDEZ-AGUILERA for

Source : MNHN, Paris

reviewing the manuscript and for his suggestions. Biol. Yolanda HORNELAS is gratefully acknowkledge for taking the scanning electron photographs of pleopods. We thank Biol. Antonio CANTÚ for drawing the figures and Pablo ROBLES and Ana MÉNDEZ of the Laboratorio of Microcine of Facultad de Ciencias, UNAM, for the photograph of the whole pleopod (pl. I A). The study was partly financed by CONACyT, México (Becaria ARVB N° 3493).

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Source : MNHN, Paris

A

B

C

PLATE I. — *Euphrosynoplax campechiensis* sp. nov., paratype (SMIOM 01665) : A, first pleopod ; B, first pleopod (40 ×) ; C, tip of first pleopod (94 ×).

Source : MNHN, Paris

A

B

PLATE II. — *Euphrosynoplax clausa* Guinot, (PROGMEXI E-32) : A, first pleopod (44 ×); tip of first pleopod (86 ×).

Source : MNHN, Paris

Source : MNHN, Paris

Bull. Mus. natl. Hist. nat., Paris, 4e sér., **13**, 1991,
section A, nos 3-4 : 439-456.

Révision préliminaire du genre *Tymolus* Stimpson, avec la description de *Tymolus brucei* sp. nov. d'Australie occidentale (Crustacea, Brachyura, Cyclodorippoidea)

par Marcos Siqueira TAVARES

Résumé. — Le genre *Tymolus* Stimpson, 1858, qui fut très longtemps confondu avec le genre *Cyclodorippe* A. Milne Edwards, 1880, compte à ce jour cinq espèces, dans la faune actuelle, toutes indo-pacifiques : *T. japonicus* Stimpson, 1858; *T. uncifer* (Ortmann, 1892); *T. truncatus* comb. nov. (Ihle, 1916), décrite à l'origine dans le genre *Cyclodorippe*, et ici transférée dans le genre *Tymolus*; *T. similis* (Grant, 1905); *T. brucei* sp. nov., espèce établie dans la présente note, provenant de la côte occidentale d'Australie, entre 456 et 506 m. Une description détaillée est fournie pour chaque espèce et une clé d'identification des cinq espèces du genre est proposée.

Abstract. — The genus *Tymolus* Stimpson, 1858, as distinct from *Cyclodorippe* A. Milne Edwards, 1880, now includes five recent species, all of them from the Indo-Pacific region : *T. japonicus* Stimpson, 1858; *T. uncifer* (Ortmann, 1892); *T. truncatus* comb. nov. (Ihle, 1916), first described in the genus *Cyclodorippe*, and now transferred to the genus *Tymolus*; *T. similis* (Grant, 1905) ; *T. brucei* new species, described herein, from western Australia between 456 and 506 m depth. A detailed description and key is given for the identification of the five species now included in the genus.

Mots-clés. — Crabes; Brachyoures bathyaux; Cyclodorippoidea; *Tymolus*; *Tymolus brucei* sp. nov.; Australie.

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INTRODUCTION

Les récoltes entreprises par le bateau « Soela » sur la côte occidentale de l'Australie ont révélé la présence d'une espèce nouvelle appartenant au genre *Tymolus* Stimpson, 1858. Son étude nous a conduit à une révision préliminaire du genre. *Tymolus brucei* sp. nov. a été récoltée à des profondeurs comprises entre 456 et 506 m.

Le matériel-type est déposé au Muséum national d'Histoire naturelle à Paris et au Northern Territory Museum à Darwin, Australie.

Source : MNHN, Paris

Matériel et méthodes

Pour l'ensemble des espèces du genre *Tymolus* étudiées ici, nous avons fait appel aux collections de divers musées, dont les abréviations suivent :

AMS = Australian Museum, Sydney.
MP = Muséum national d'Histoire naturelle, Paris.
NTM = Northern Territory Museum of Arts and Science, Darwin.
QM = Queensland Museum, Brisbane.
USNM = National Museum of Natural History, Smithsonian Institution, Washington.

La terminologie utilisée pour désigner les différentes structures de la carapace est indiquée sur une représentation schématique d'un Cyclodorippidé (fig. 1). Autres abréviations : St. = station, T = drague.

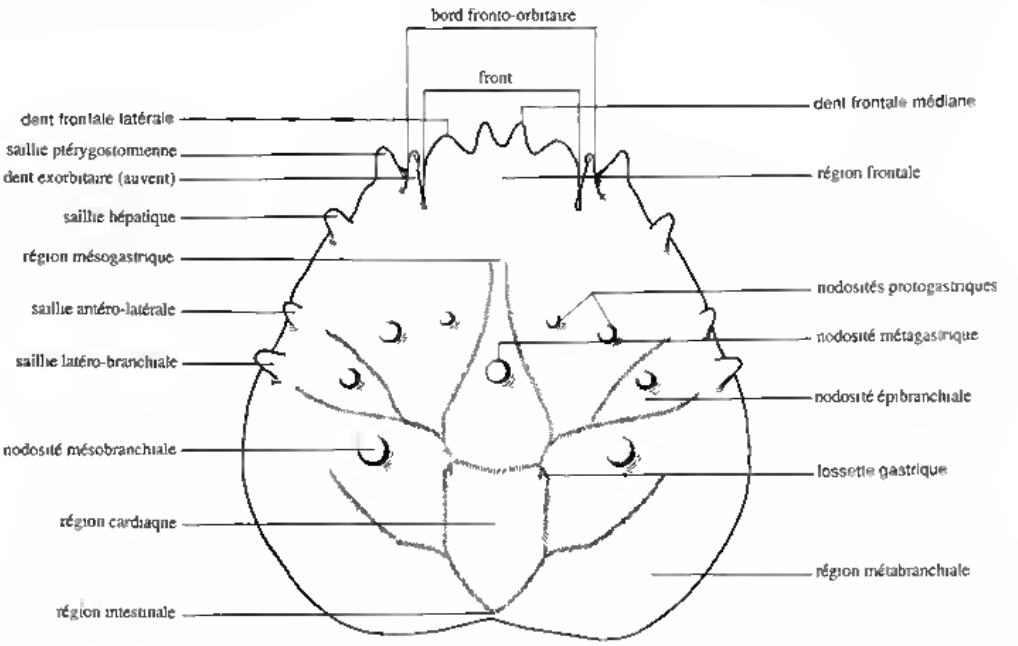

Fig. 1. — Carapace, vue dorsale schématique : terminologie utilisée pour désigner les différentes structures de la carapace.

Cyclodorippidae Ortmann, 1892

Cyclodorippidae Ortmann, 1892 : 552.
Cyclodorippidae; Stebbing, 1920 : 242; Manning et Holthuis, 1981 : 28; Abele et Kim, 1986 : 39; Tavares, 1990 : 626.
Tymolinae Alcock, 1986 : 274, 289 (*pro parte*).
Tymolinae; Grant, 1905 : 315; Balss, 1957 : 1609 (*pro parte*); Glaessner, 1969 : R492 (*pro parte*); Gordon, 1963 : 57; Stevcic, 1969 : 82; Guinot, 1978 : 243.

Source : MNHN, Paris

Cyclodorippinae; Bouvier, 1897 : 4; A. Milne Edwards et Bouvier, 1899 : 16, 17; 1902 : 74, 84; Ihle, 1916 : 118; Bouvier, 1940 : 195, 196; Barnard, 1950 : 388 (pro parte).
Cyclodorippae; Bouvier, 1897 : 7; A. Milne Edwards et Bouvier, 1899 : 16, 17; 1902 : 74, 84; Barnard, 1950 : 388.
Tymolidae; Gordon, 1963 : 57 (*pro parte*); Stevcic, 1969 : 82 (*pro parte*); 1971 : 190; Sakai, 1976 : 32 (*pro parte*); Guinot, 1978 : 243 (*pro parte*); Kensley, 1981 : 37; Briggs, Fortey et Clarkson, 1988 : 199, 200; Takeda et Tomida, 1984 : 43; Wicksten, 1986 : 364.

La famille des Cyclodorippidae compte dans la faune actuelle six genres, à savoir : *Tymolus* Stimpson, 1858; *Corycodus* A. Milne Edwards, 1880; *Cyclodorippe* A. Milne Edwards, 1880; *Clythrocerus* A. Milne Edwards et Bouvier, 1899; *Xeinostoma* Stebbing, 1920; *Simodorippe* Chace, 1940. Il conviendra d'y ajouter quatre nouveaux genres indo-pacifiques, dont la description est en préparation.

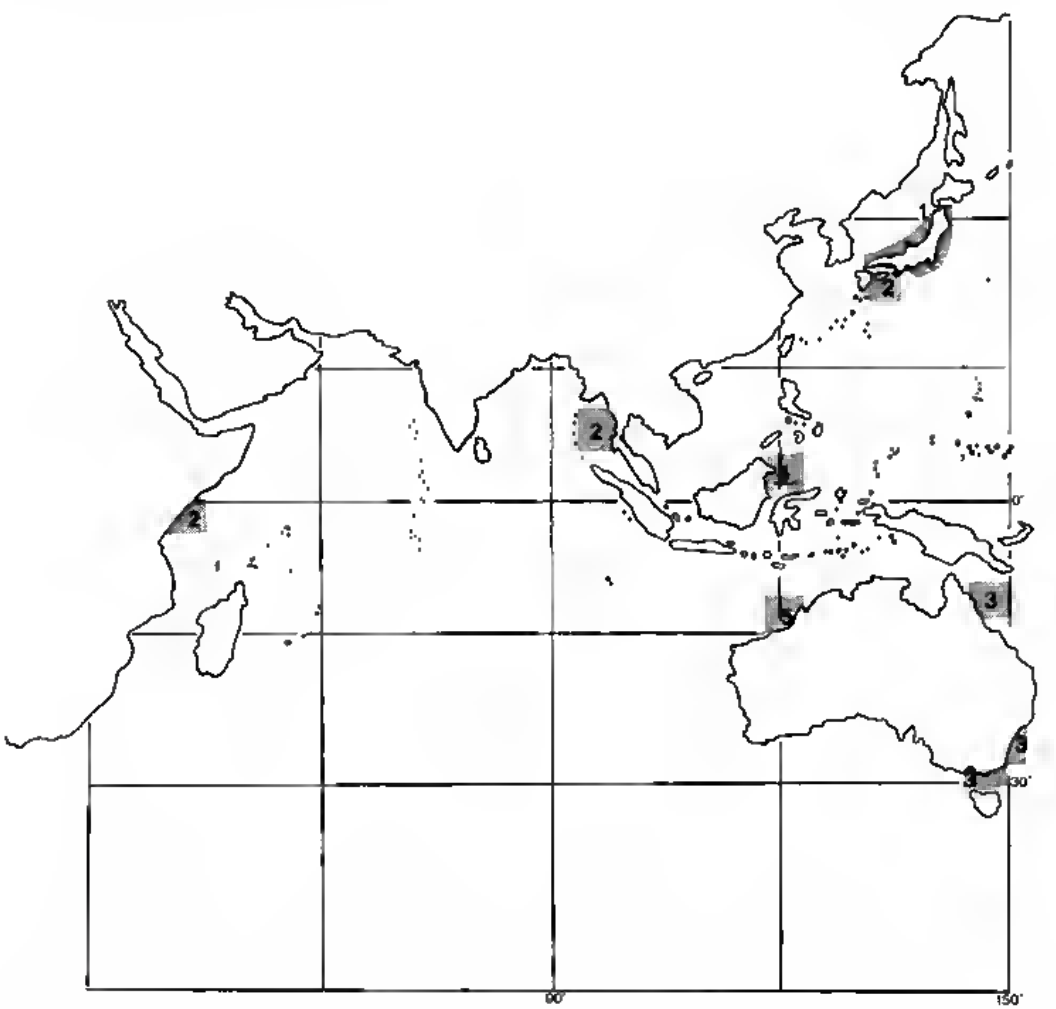

Fig. 2. — Distribution géographique des espèces actuelles du genre *Tymolus* Stimpson : 1, *Tymolus japonicus*, 1858; 2, *Tymolus uncifer* (Ortmann, 1892); 3, *Tymolus similis* (Grant, 1905); 4, *Tymolus truncatus* comb. nov. (Ihle, 1916); 5, *Tymolus brucei* sp. nov.

Source : MNHN, Paris

TYMOLUS Stimpson, 1858

Tymolus Stimpson, 1858 : 163 [espèce-type par monotypie : *Tymolus japonicus* Stimpson, 1858]; Ortmann, 1892 : 559; Alcock, 1896 : 274; Balss, 1957 : 1609; Gordon, 1963 : 53; Glaessner, 1969 : R492; Stevcic, 1969 : 75; Sakai, 1976 : 32; Guinot, 1978 : 243; 1979 : 129; Abele et Felgenhauer, 1982 : 316; Takeda et Tomida, 1984 : 43.

Cyclodorippe (*pro parte*) : Ortmann, 1892 : 559; Alcock, 1896 : 274; Ihle, 1916 : 128; Sakai, 1976 : 32; Abele et Felgenhauer, 1982 : 316; Abele et Kim, 1986 : 39 (non *Cyclodorippe* A. Milne-Edwards, 1880).

Cymonomops Alcock, 1894 : 406 [espèce-type par monotypie : *Cymonomops glaucomma* Alcock, 1894]; 1896 : 274, 286; 1905 : 572; Grant, 1905 : 315.

Cyclodorippe (*Cyclortmannia*) Ihle, 1916 : 128 [espèce-type par présente sélection : *Tymolus uncifer* (Ortmann, 1892)].

Les genres *Tymolus* Stimpson, 1858, et *Cyclodorippe* A. Milne Edwards, 1880, ont été confondus jusqu'à ce qu'une étude de la carapace, des yeux et, surtout, des structures respiratoires et du sternum thoracique, impose de revenir à une séparation des deux genres (Tavares, 1990). Le genre *Tymolus*, exclusivement indo-pacifique (carte, fig. 2), est maintenant constitué de cinq espèces suivantes : *Tymolus japonicus* Stimpson, 1858 (espèce-type du genre); *T. uncifer* (Ortmann, 1892); *T. truncatus* comb. nov. (Ihle, 1916), espèce originellement décrite dans le genre *Cyclodorippe* et ici transférée dans le genre *Tymolus*, cf. infra, *T. similis* (Grant, 1905); *T. brucei* sp. nov.

Pour sa part, le genre *Cyclodorippe* renferme cinq espèces, toutes de l'Atlantique occidental, à savoir : *Cyclodorippe agassizii* A. Milne Edwards, 1880 (espèce-type du genre), *C. antennaria* A. Milne Edwards, 1880; *C. bouvieri* Rathbun, 1934; *C. ornata* Chace, 1940; *C. angulata* Tavares, 1990.

Clé des espèces du genre *Tymolus* Stimpson

1 — Front découpé en quatre dents 2
— Front tronqué ..... *Tymolus truncatus* (Ihle)
2 — Saillies ptérygostomienne, hépatique, antéro-latérale et latéro-branchiale très prononcées; dent exorbitaire contiguë avec la dent frontale externe ..... *Tymolus japonicus* Stimpson
— Pas de saillie ptérygostomienne; saillies hépatique, antéro-latérale et latéro-branchiale (si présentes) en général faiblement marquées; dent exorbitaire jamais contiguë avec la dent frontale externe. 3
3 — Mérus de P2 considérablement plus long que l'ensemble carpe + propode + dactyle ..... *Tymolus brucei* sp. nov.
— Mérus de P2 aussi long que l'ensemble carpe + propode + dactyle 4
4 — Saillie latéro-branchiale plus petite que la saillie antéro-latérale; saillie hépatique à peine visible; carapace très finement granuleuse et peu sétifère; granulation des Mxp3 très faible ..... *Tymolus uncifer* (Ortmann)
— Pas de saillie latéro-branchiale; saillie antéro-latérale pointue et dirigée vers l'avant; carapace granuleuse et sétifère; des granules spiniformes sur Mxp3 ..... *Tymolus similis* (Grant)

Source : MNHN, Paris

Tymolus japonicus Stimpson, 1858
(Fig. 2, 3, 9A, 10A)

Tymolus japonicus Stimpson, 1858 : 163; Ortmann, 1892 : 559; A. Milne Edwards et Bouvier, 1902 : 109; Stimpson, 1907 : 169; Balss, 1922 : 116; Yokoya 1933 : 105; Sakai, 1935 : 65, 1937 : 69; Gordon, 1963 : 51; Glaessner, 1969 : R492; Sakai, 1976 : 33; Guinot, 1979 : 174; Tavares, 1990 : 629.
Cyclodorippe dromioides Ortmann, 1892 : 559; Bouvier, 1897 : 13; Doflein, 1904 : 34; Alcock, 1905 : 572; Parisi, 1914 : 29.
Cyclodorippe (*Cyclortmannia*) *dromioides*; Ihle, 1916 : 129.

Matériel examiné. — Japon, Hakodate : 6 ♂ (le plus grand : 10,4 × 12 mm, le plus petit : 7 × 8 mm) et 1 ♀ ovigère : 9 × 10 mm (USNM 45844).

Description

Carapace subcirculaire, plus élargie en arrière à partir de la saillie latéro-branchiale. Front découpé en quatre dents, les deux médianes plus allongées et dirigées vers l'extérieur. Dent exorbitaire contiguë avec la dent frontale externe, concave sur la face interne et creusée en forme d'auvent. Bord fronto-orbitaire nettement moins large que la moitié de la largeur maximale de la carapace. Saillie ptérygostomienne spatulée, très proéminente. Saillie hépatique prononcée, avec l'extrémité arrondie. Au-dessous de la saillie antéro-latérale, un petit tubercule pointu et, plus bas, une petite nodosité. Saillie antéro-latérale plus petite que les autres, notablement rapprochée de la saillie latéro-branchiale, elle-même proéminente. Région frontale fortement creusée à sa surface; zone en avant de la région mésogastrique déprimée. Deux nodosités protogastriques paires, les internes étant à peine visibles. Une nodosité métagastrique impaire; de chaque côté de celle-ci, une nodosité épibranchiale faible. Nodosités mésobranchiales paires à peine reconnaissables. Pas de nodosités sur la région métabranchiale. Fossettes gastriques bien marquées. Régions cardiaque et intestinale nettement renflées, délimitées de chaque côté par un sillon assez profond. Toute la carapace ainsi que ses ornements recouverts de granules fins. Pilosité sur la carapace plutôt faible, visible surtout en avant.

Yeux mobiles, très courts, rétractiles, alignés dans un sens longitudinal par rapport à la longueur de la carapace. Cornée bien pigmentée.

Troisième maxillipède sétifère, bien plus long que large. Palpe inséré sur la face interne du mérus. Exopodite dénué de flagelle. Endostome s'allongeant jusqu'au bord frontal de la carapace et formant une sorte de gouttière qui se rétrécit vers l'avant et qui s'intercale entre les dents internes du front.

Chélipèdes égaux, assez robustes. Granulation beaucoup plus accusée sur les chélipèdes que sur la carapace. Face interne des deux doigts sétifère. Carpe avec une dent triangulaire, spinuleux et sétifère sur le bord interne.

Spinulation des péréiopodes 2 et 3 (P2 et P3) faibles. Mérus de P2 aussi long que l'ensemble du carpe + propode + dactyle. Tiers distal du dactyle comprimé dorso-ventralement.

Source : MNHN, Paris

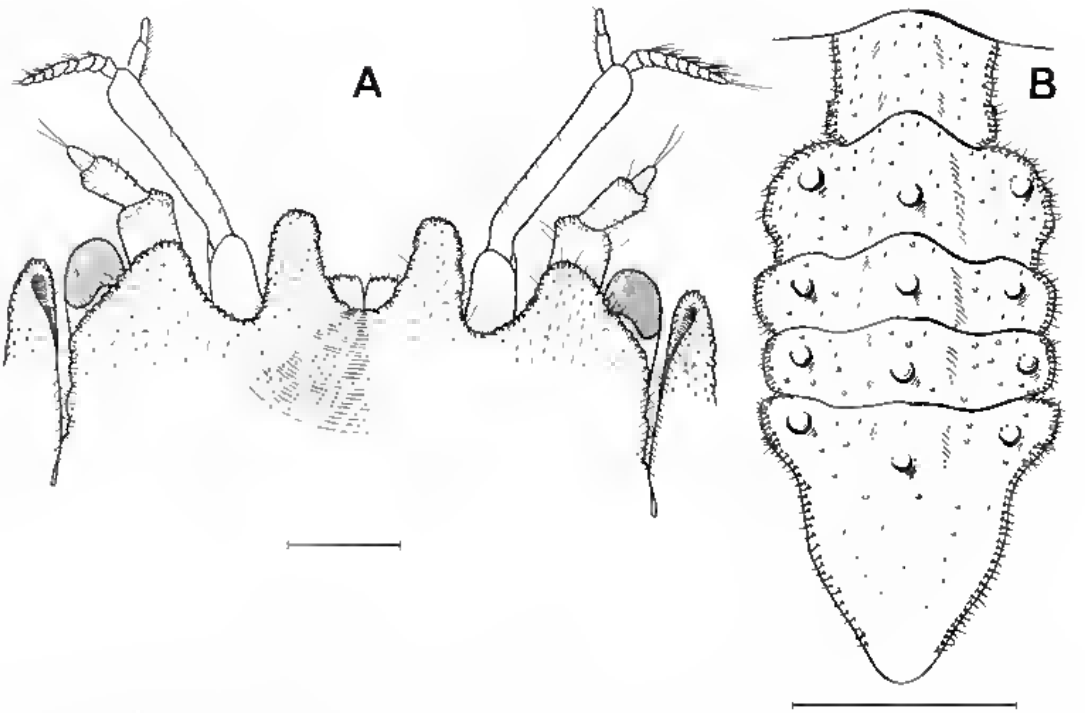

FIG. 3. — *Tymolus japonicus* Stimpson, 1858, ♂ 10,4 × 10,3 mm, Hakodate, Japon (USNM 45844) : A, bord frontal de la carapace; B, face ventrale de l'abdomen. Échelle: 1 mm.

Abdomen mâle de cinq segments. Une série transverse de trois nodosités sur les quatre derniers segments.

Femelle avec un abdomen de six segments; sternum thoracique avec la suture 6/7 ininterrompue.

REMARQUES. — SAKAI (1976 : 33) a étudié un spécimen anormal provenant de Manazuru, dont le front présente deux dents au lieu de quatre. Le plus grand spécimen de *T. japonicus* que nous ayons examiné est un mâle (10,4 × 12 mm), dont la saillie ptérygostomienne gauche est bifide, tandis que la droite est simple. D'aprés SAKAI (1976 : 33), cette espéce habite entre 50 et 350 m de profondeur, sur des fonds de vase ou de sable.

DISTRIBUTION. — L'espéce est endémique du Japon, oú elle est connue des localités de Hakodate, île Hokkaido, jusqu'á l'ouest de l'île Tanegashima au sud de l'île Kyushu.

Tymolus uncifer (Ortmann, 1892)
(Fig. 2, 4, 8A, 9B, 10B)

Cyclodorippe uncifera Ortmann, 1892 : 560; BOUVIER, 1897 : 13; DOFLEIN, 1902 : 653; 1904 : 34; PARISI, 1914 : 29.

Cymonomops glaucomma Alcock, 1894 : 406; ALCOCK et ANDERSON, 1896 : pl. 4, fig. 9, 9a; ALCOCK, 1896 : 287; BOUVIER, 1897 : 13; GRANT, 1905 : 317.

Source : MNHN, Paris

Cyclodorippe uncifera glaucomma; DOFLEIN, 1904 : 35.
Cyclodorippe uncifera melanomma Doflein, 1904 : 35.
Cyclodorippe (*Cyclortmannia*) *uncifera*; IHLE, 1916 : 133.
Tymolus uncifer; BALSS, 1922 : 286; YOKOYA, 1913 : 103; SAKAI, 1937 : 70; 1965 : 21; 1976 : 33.

MATÉRIEL EXAMINÉ. — Japon, baie de Tosa, île Shikoku, 9.11.1965 : 4 ♂ et 4 ♀ ovigères (USNM 120712).

DESCRIPTION

Carapace subcirculaire, plus élargie en arrière de la saillie latéro-branchiale. Front découpé en quatre dents, les deux médianes se bifurquant à partir d'une base assez allongée. Dent exorbitaire nettement écartée de la dent frontale externe, légérement concave, en forme d'auvent oblique. Bord fronto-orbitaire visiblement moins large que la moitié de la largeur maximale de la carapace. Saillie ptérygostomienne absente; saillie hépatique à peine visible; saillie antéro-latérale plus grande que la saillie latéro-branchiale, ces deux saillies étant très rapprochées l'une de l'autre. Région frontale fortement creusée à sa surface; zone en avant de

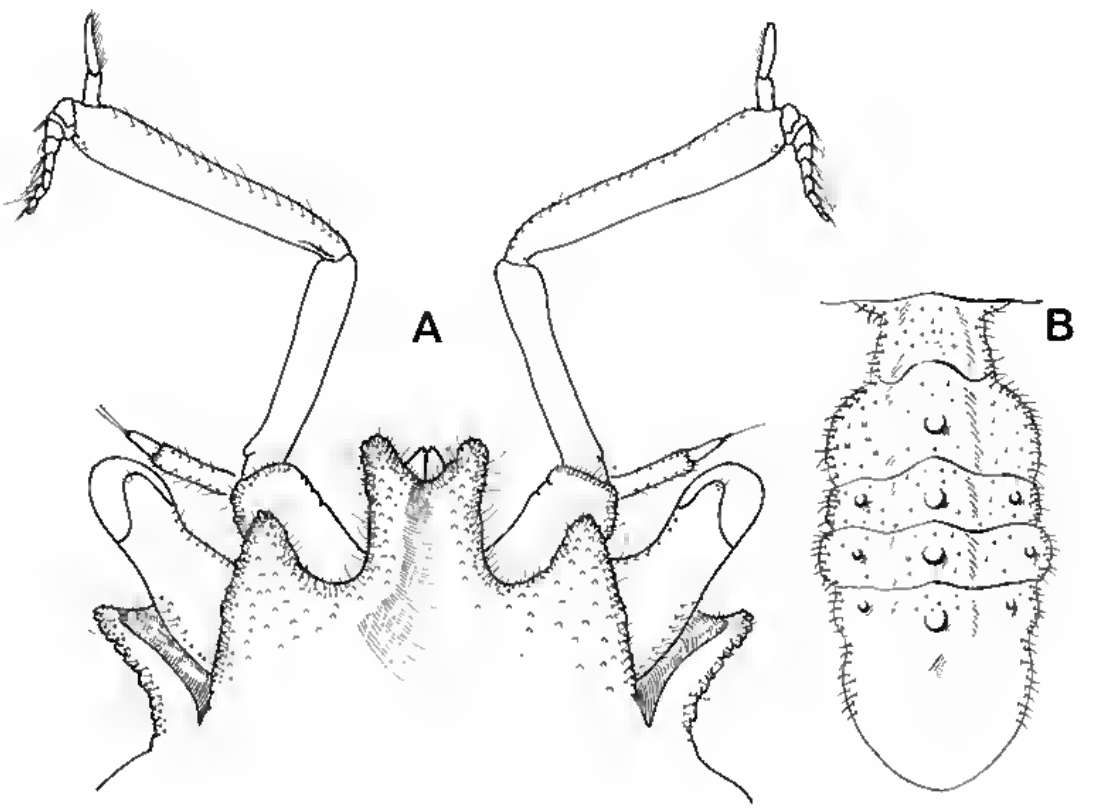

FIG. 4. — *Tymolus uncifer* (Ortmann, 1892), ♂ 0,6 × 0,6 mm, Baie de Tosa, îles Shikoku (USNM 120712). A, bord frontal de la carapace; B, face ventrale de l'abdomen. Échelle : 1 mm.

Source : MNHN, Paris

la région mésogastrique déprimée. Nodosités protogastriques, métagastrique, épibranchiales et mésobranchiales à peine indiquées. Région métabranchiale bombée. Fossettes gastriques nettement marquées. Régions cardiaque et surtout intestinale très renflées et délimitées du côté externe par un sillon assez profond.

Granulation de la carapace plus marquée sur la région métabranchiale. Pilosité de la carapace plutôt faible, visible principalement dans la partie antérieure.

Pédoncule oculaire remarquablement plus long que chez *Tymolus japonicus*, rètractiles, alignés dans un sens longitudinal par rapport à la longueur de la carapace. Cornée bien distincte, dépigmentée.

Troisième maxillipède sétifère, nettement plus long que large. Palpe inséré sur la face interne du mérus. Exopodite dénué de flagelle. Endostome s'allongeant jusqu'à toucher le bord frontal de la carapace et formant une sorte de gouttière, plus étroite vers l'avant.

Chélipèdes égaux, assez robustes. Granulation plus accusée sur les chèlipèdes que sur la carapace. Face interne des deux doigts sétifère. Bord interne du carpe avec une proéminence granuleuse et très sétifère.

P2 et P3 faiblement spinuleux. Mérus de P2 aussi long que l'ensemble du carpe + propode + dactyle. Tiers distal du dactyle comprimé dorso-ventralement.

Chez le mâle, abdomen de cinq segments; sur les trois derniers, une série transversale de trois nodosités (moins nettes que chez *Tymolus japonicus*). Femelle avec un abdomen de six segments; sternum thoracique avec la suture 6/7 ininterrompue.

REMARQUES. — La comparaison de *T. uncifer* (Ortmann) et *T. glaucomma* (Alcock) nous a amené à considérer cette dernière comme un synonyme plus récent de *Tymolus uncifer* (Ortmann). N'ayant pu examiner le matériel-type de *T. glaucomma*, nous nous sommes basé sur les illustrations d'ALCOCK et ANDERSON (1896 : pl. 14, fig. 9, 9a). C'est pour cette même raison que nous avons provisoirement retenu dans la synonymie de *T. uncifer* (Ortmann) les taxons décrits par DOFLEIN (1904). Selon ce dernier auteur (*ibid.* : 34-35), *T. uncifer* (Ortmann) se partagerait en deux « formes » distinctes : *T. uncifer glaucomma* Alcock, 1894, et *T. uncifer melanomma* Doflein, 1904. *T. japonicus* et *T. uncifer* ont apparemment le même biotope. Cette dernière espèce habite sur des fonds de vase ou de sable, entre 50 et 729 m de profondeur.

DISTRIBUTION. — *T. uncifer* est connu du Japon (Honshu, Shikoku et Kyushu) et de la mer des Andaman. Si les deux mâles provenant de la côte est-africaine (0°27,4' S-42°47,3' E), examinés par DOFLEIN (1904 : 35), s'avèrent appartenir effectivement à *T. uncifer*, la distribution de l'espèce est considérablement agrandie, puisqu'elle s'ètendrait jusqu'à l'océan Indien occidental.

Tymolus truncatus comb. nov. (Ihle, 1916)
(Fig. 2, 5)

Cyclodorippe (*Cyclortmannia*) *truncata* Ihle, 1916 : 135, fig. 72, 73.

Cette espèce a été décrite dans le genre *Cyclodorippe* A. Milne Edwards, 1880, par IHLE (1916 : 135), d'après deux mâles et trois femelles récoltés sur la côte est de Borneo, à 281 m de profondeur

Source : MNHN, Paris

Toutefois, comme nous l'avons déjà remarqué (TAVARES, 1990 : 627-630), dans le genre *Cyclodorippe* le bord fronto-orbitaire est beaucoup plus large que la moitié de la largeur maximale de la carapace; chez *Tymolus*, le bord fronto-orbitaire est bien moins large (fig. 1). Le genre *Cyclodorippe* ne possède pas d'yeux rétractiles; d'ailleurs, ils sont toujours cachés dans une orbite et orientés dans un sens perpendiculaire à l'axe longitudinal du corps; à l'inverse le genre *Tymolus* est caractérisé par des yeux rétractiles, alignés dans un sens longitudinal par rapport à la longueur de la carapace. Chez *Cyclodorippe*, l'endostome ne touche pas le bord frontal de la carapace, tandis que, dans le genre *Tymolus*, il s'allonge jusqu'au bord frontal. L'examen des illustrations de l'espèce établie par IHLE est suffisant pour décider de son transfert dans le genre *Tymolus* Stimpson.

Tymolus truncatus comb. nov. (Ihle, 1916), au front tronqué (d'où vient son nom spécifique *truncatus*), se distingue des quatre autres espèces du genre *Tymolus* qui offrent toutes un front découpé en quatre dents.

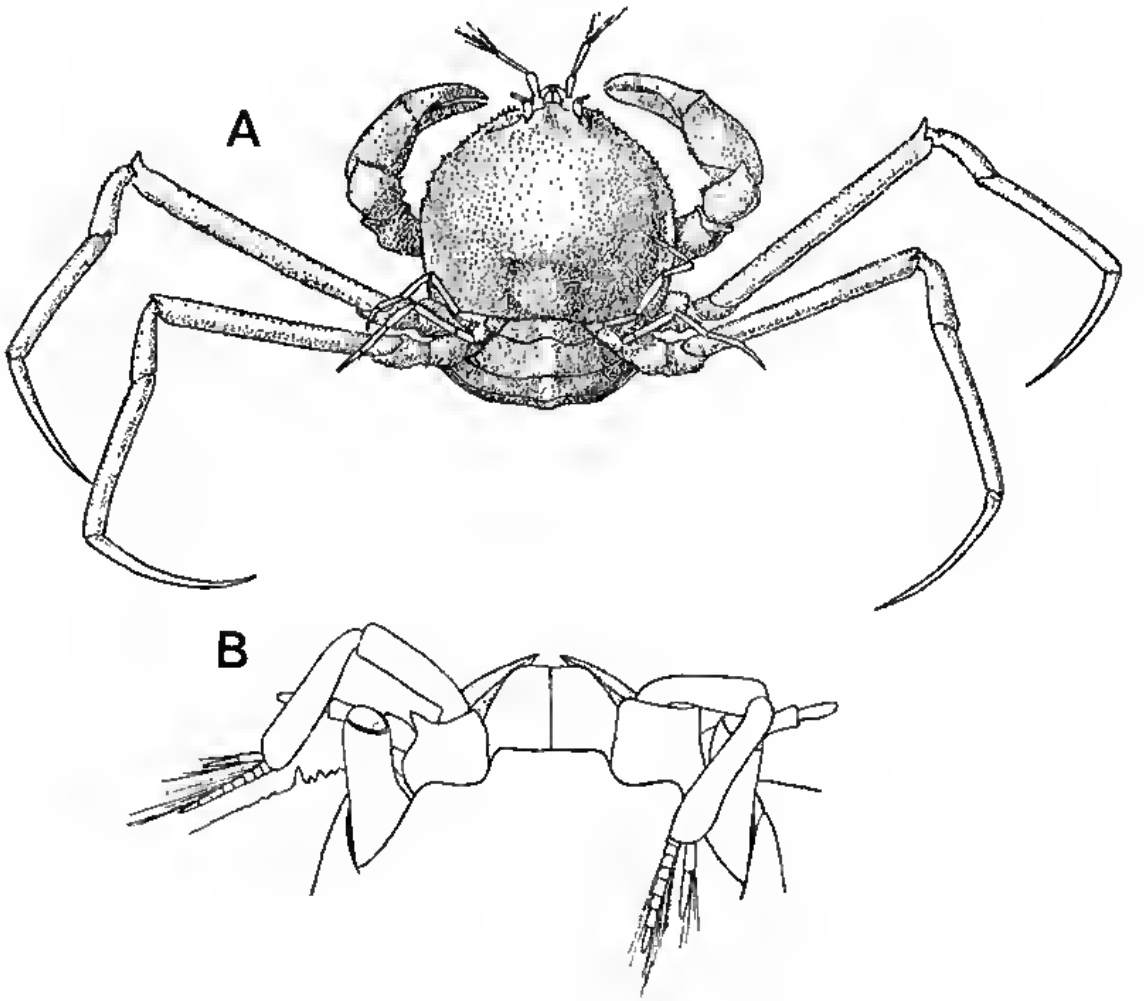

FIG. 5. — *Tymolus truncatus* comb. nov. (Ihle, 1916), 1°17,5' N-118°53' W. Femelle : A, vue d'ensemble; B, bord frontal de la carapace d'après IHLE (1916 : fig. 72, 73).

Source : MNHN, Paris

DISTRIBUTION. — Cette espèce n'est connue, jusqu'à présent, que de la localité-type, Borneo (1°17,5' N-118°53' W), et n'a jamais été retrouvée.

Tymolus similis (Grant, 1905)
(Fig. 2, 6, 9C)

Cymonomops similis Grant, 1905 : 315, pl. 10, fig. 1.
Cyclodorippe (*Cyclorimannia*) *similis*; IHLE, 1916 : 128 (clef et cit.).

MATÉRIEL EXAMINÉ. — Sud du Cap York : 17°34' S-146°53' E, 500 m, 15.5.1986 : 1 ♂ (QM W 15394); *ibid.* : 4 ♀ (QM W 15378). New South Wales : 28 miles à l'est de Port Jackson, 450-540 m, 3.1905 : syntypes, 1 ♂ 5,6 × 6 mm, et 1 ♀ 6,7 × 7 mm (AMS-P, 5426); *ibid.* : R. J. Mc INTYRE, CSIRO, Cronulla, 16.5.1965 : 1 ♀ (AMS-P. 16106); *ibid.* : 22 miles au nord de l'île de Gabo, K. MOLLER, 135 m, 8.1929 : 1 ♀ (AMS-P. 9393); *ibid.* : 20 miles au nord de l'île de Gabo, K. MOLLER, 117 m, 9.1935 : 1 ♂ and 4 ♀ (AMS-P. 11737); *ibid.* : 10 miles au large de l'île de Gabo, K. MOLLER, 135 m, 10.1929 : 1 ♂ and 4 ♀ (AMS-P. 9394) Victoria : île Babel, Bass Strait, 90-144 m, 1913 : 2 ♂ AMS-E. 4818); *ibid.* : « Endeavour », CSIRO, 90-144 m, 4.1923 : 1 ♂ (AMS-P. 6185).

DESCRIPTION

Carapace subcirculaire, légèrement élargie en arrière. Front découpé en quatre dents, les deux médianes se séparant à partir d'une base allongée. Dent exorbitaire nettement éloignée de la dent frontale externe et en forme d'auvent. Bord fronto-orbitaire bien moins large que la moitié de la largeur maximale de la carapace. Saillie ptérygostomienne absente. Saillie hépatique représentée par une nodosité faible; saillie antéro-latérale très pointue et dirigée vers l'avant, ornée sur le dessus de granules spiniformes. Pas de saillie latéro-branchiale. Région frontale fortement creusée à sa surface; région mésogastrique déprimée vers l'avant. Nodosités protogastriques, métagastrique et épibranchiales peu indiquées. Région métabranchiale faiblement bombée. Fossettes gastriques bien marquées. Régions cardiaque et intestinale bien renflées, délimitées de chaque côté par un sillon.

Des granules spiniformes distribués régulièrement sur la face dorsale de la carapace et sur la région ptérygostomienne, Pilosité nettement plus dense que chez les autres espèces du genre.

Yeux rétractiles, alignés dans le sens longitudinal par rapport à la longueur de la carapace. Cornée faiblement pigmentée.

Troisième maxillipède (Mxp3) sétifère, long par rapport à sa largeur; sa face externe ornée de granules spiniformes et bien distinct. Palpe inséré sur la face interne du mérus. Exopodite dénué de flagelle. Endostome s'allongeant jusqu'au bord frontal de la carapace et formant une sorte de gouttière, se rétrécissant vers l'avant.

Chélipèdes égaux. Face interne des deux doigts très sétifère, de forme et d'ornementations variables (cf. *infra*). Bord interne du carpe avec une projection spinuleuse et sétifère.

P2 et P3 très peu spinuleux. Mérus de P2 aussi long que l'ensemble du carpe + propode + dactyle. Tiers distal du dactyle légèrement comprimé dorso-ventralement.

Abdomen mâle montrant cinq segments; une série transversale de nodosités réduites sur les trois derniers segments abdominaux. Abdomen de la femelle montrant six segments. Sternum thoracique avec la suture 6/7 ininterrompue.

Source : MNHN, Paris

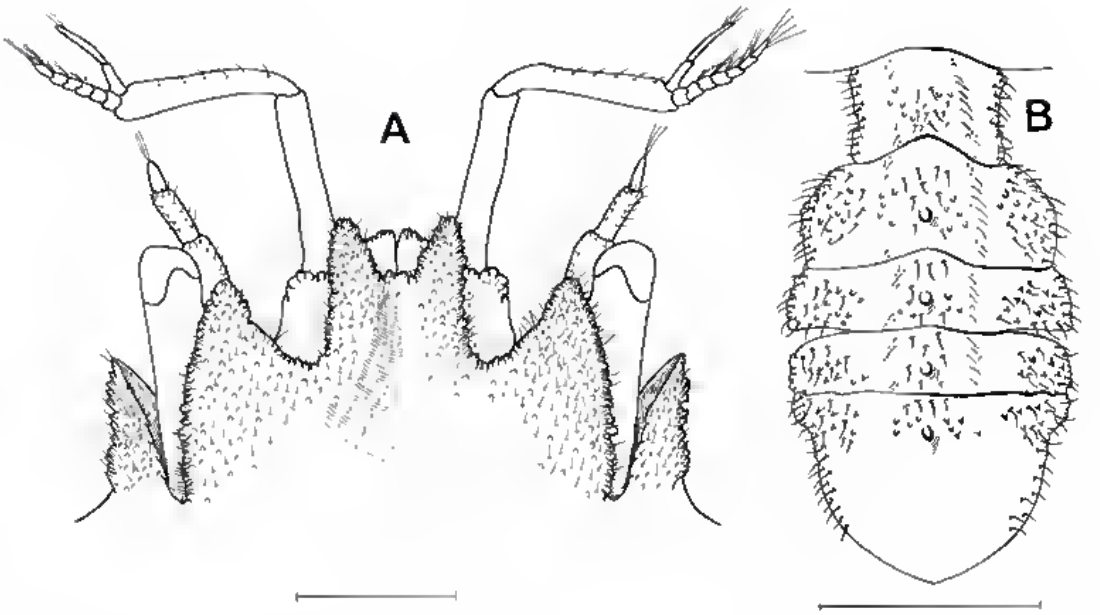

FIG. 6. — *Tymolus similis* (Grant, 1905), ♂ 9 × 9,5 mm, Crowdy Head, N. S. W. (AMS-P. 11742) : A, bord frontal de la carapace ; B, face ventrale de l'abdomen. Échelle : 1 mm.

REMARQUES. — Ayant pu comparer au matériel typique de Sydney un échantillon du Cap York (voir fig. 2, les localités n° 3) nous pouvons formuler les remarques suivantes. *Tymolus similis* montre une trés forte variation de la forme et de l'ornementation des doigts fixe et mobile du chélipéde. Une telle variation n'existe chez aucune autre espéce du genre. Les spécimens provenant de la région au sud du Cap York (1 mâle et quatre femelles, QM-W 15394 : voir matériel examiné), présentent des doigts assez larges par rapport á leur longueur, avec un bord préhensile orné de dents peu prononcées ; le doigt mobile est trés incurvé ; la granulation de la main et de la face externe de la pince est faible. Plusieurs spécimens, mâles et femelles, récoltés au large de Sydney et du détroit de Bass, possédent les doigts droits et minces, dont le bord préhensile est armé de dents aiguës ; la main, sur ses deux faces, le bord supérieur du doigt mobile et la face externe des deux doigts sont ornés des nombreux granules pointus. Dans le matériel de l'Australie méridionale, quelques mâles et femelles montrent une forme de chélipéde intermédiaire : les deux doigts sont assez minces, mais le doigt mobile est incurvé comme chez les spécimens provenant de la région du Cap York ; les dents du bord préhensile sont plutôt aiguës et la granulation est intermédiaire entre les deux types observés ci-dessus. En outre, les spécimens du nord-est de l'Australie sont les seuls á présenter une nodosité nette sur la région métabranchiale, sauf chez le jeune mâle. Il est probable qu'une étude ultérieure, fondée sur des échantillons plus nombreux, amène â considérer l'existence d'une deuxiéme espéce dans le nord de l'Australie.

DISTRIBUTION. — *Tymolus similis* (Grant) est connue de la région au sud du Cap York, au large de Sydney, et du détroit de Bass. Le matériel étudié ici provient de profondeurs comprises entre 90 et 500 m.

Source : MNHN, Paris

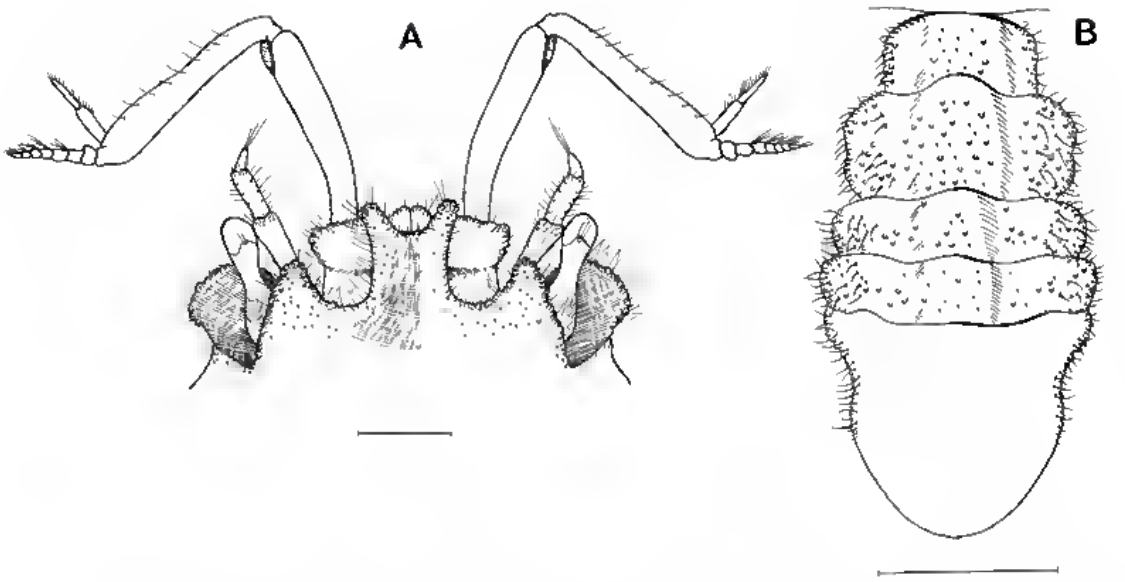

FIG. 7. — *Tymolus brucei* sp. nov., holotype, ♂ 4 × 5 mm, 18°52,2'S-116°11,1'E (NTM-Cr. 001179) : A, bord frontal de la carapace ; B, face ventrale de l'abdomen. Échelle : 1 mm.

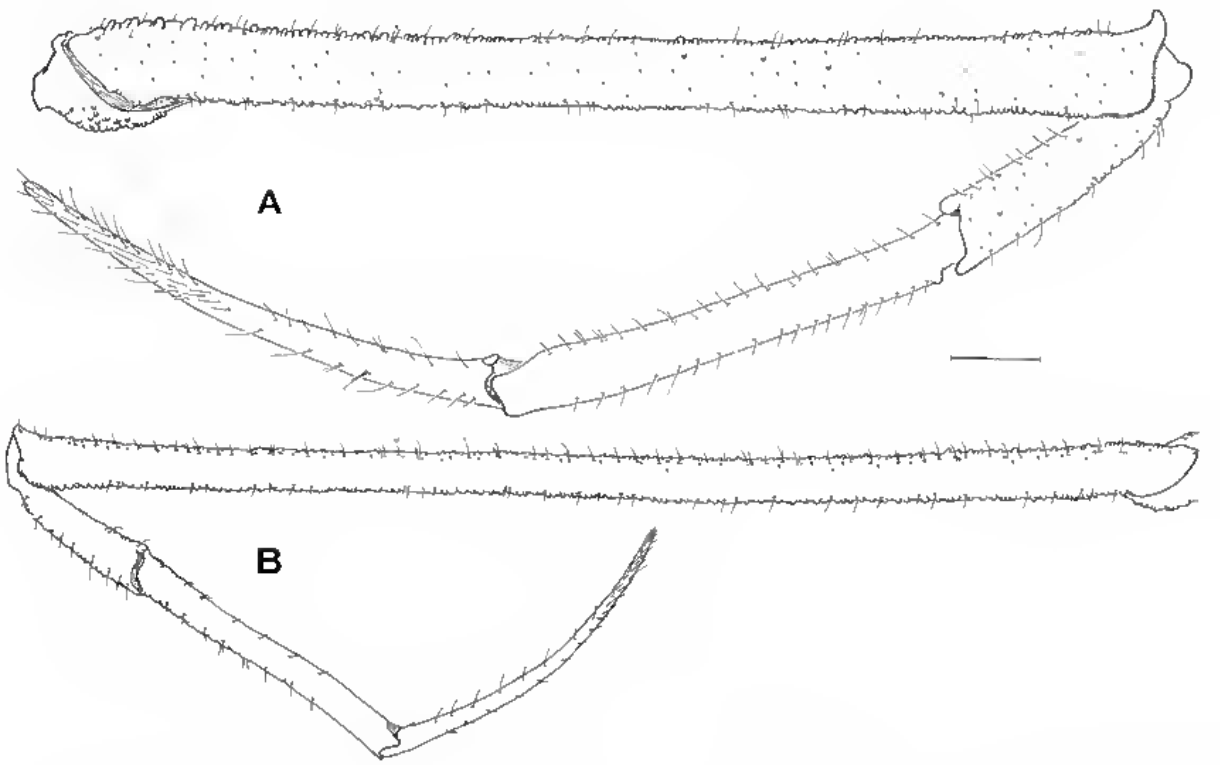

FIG. 8. — Deuxième péréiopode (P2) : A, *Tymolus uncifer* (Ortmann, 1892), ♂ 0,6 × 0,6 mm, baie de Tosa, île Shikoku (USNM 120712) ; B, *Tymolus brucei* sp. nov., holotype, ♂ 4 × 5 mm, 18°52,2'S-116°11.1'E (NTM-Cr. 001179). Échelle : 1 mm.

Source : MNHN, Paris

Tymolus brucei sp. nov.
(Fig. 2, 7, 8B, 9D, 10C)

ÉTYMOLOGIE. — En hommage à Alexander J. BRUCE, qui a bien voulu nous confier, pour étude, les *Tymolus* récoltés par le navire « Soela ».

MATÉRIEL-TYPE. — Australie : FRV « Soela » CSIRO 0184, st. NWS-38, 18°52,2' S-116°11,1' E, T/12, 458-456 m, 30.1.1984 : holotype, ♂ 4 × 5 mm (NTM-Cr. 001179).

LOCALITÉ-TYPE. — Au large de la côte ouest d'Australie (18°52,2' S-116°11,1' E).

MATÉRIEL EXAMINÉ. — Australie : FRV « Soela » CSIRO 0184, st. NWS-57, 17°30,1' S-118°28,9' E, T/33, 504-506 m, 3.2.1984 : paratype, ♀ 5,5 × 6 mm (MP-B 24460). *Ibid.* : Australie : FRV « Soela » CSIRO 0184, st. NWS-38, 18°52,2' S-116°11,1' E, T/12, 458-456 m, 30.1.1984 : holotype, ♂ 4 × 5 mm (NTM-Cr. 001179).

DESCRIPTION DE L'HOLOTYPE (mâle)

Carapace subcirculaire, plus élargie en arrière. Front découpé en quatre dents (dont la forme varie selon les individus), les médianes se bifurquant à partir d'une base assez allongée. Dent exorbitaire légèrement concave, très écartée de la dent frontale externe. Bord fronto-orbitaire nettement moins large que la moitié de la largeur maximale de la carapace. Saillie ptérygostomienne absente ; saillie hépatique représentée par une nodosité extrêmement faible, ornée de granules pointus ; saillie antéro-latérale très réduite, munie de granules à sa surface. Saillie latéro-branchiale absente. Nodosités protogastrique, métagastrique, épibranchiale et métabranchiale peu prononcées. Région métabranchiale très peu renflée. Fossettes gastriques très marquées. Régions cardiaque et intestinale bombées, délimitées de chaque côté par un sillon net. Granulation et pilosité de la carapace plus abondantes en avant, sur la région ptérygostomienne et sur les côtés de la carapace.

Pédoncule oculaire allongé, rétractile, aligné dans un sens longitudinal par rapport à la longueur de la carapace. Cornée dépigmentée, peu distincte.

Troisième maxillipède très sétifère et long par rapport à sa largeur. Palpe inséré sur la face interne du mérus. Exopodite dénué de flagelle. Endostome s'allongeant jusqu'au bord frontal de la carapace et formant une sorte de gouttière, se rétrécissant vers l'avant.

Chélipèdes égaux. Carpe muni d'une proéminence sur le bord interne, lui-même muni de granules pointus. Doigts plutôt minces, assez sétifères. Dents du bord préhensile très peu aiguës.

P2 et P3 spinuleux. Mérus de P2 beaucoup plus long que l'ensemble carpe + propode + dactyle. Tiers distal du dactyle comprimé dorso-ventralement.

Abdomen granuleux, de cinq segments, avec des soies denses et courtes sur ses bords.

Femelle paratype plus grande que le mâle holotype mais similaire. Chélipèdes égaux. Abdomen de six segments. Sternum thoracique avec la suture 6/7 ininterrompue.

REMARQUES. — Cette espèce, voisine de *T. uncifer* et *T. similis* par la forme et la disposition des saillies sur la carapace, ainsi que par le front quadridenté, se distingue facilement des autres espèces du genre, principalement par le mérus de P2 beaucoup plus long que l'ensemble carpe + propode + dactyle.

Source : MNHN, Paris

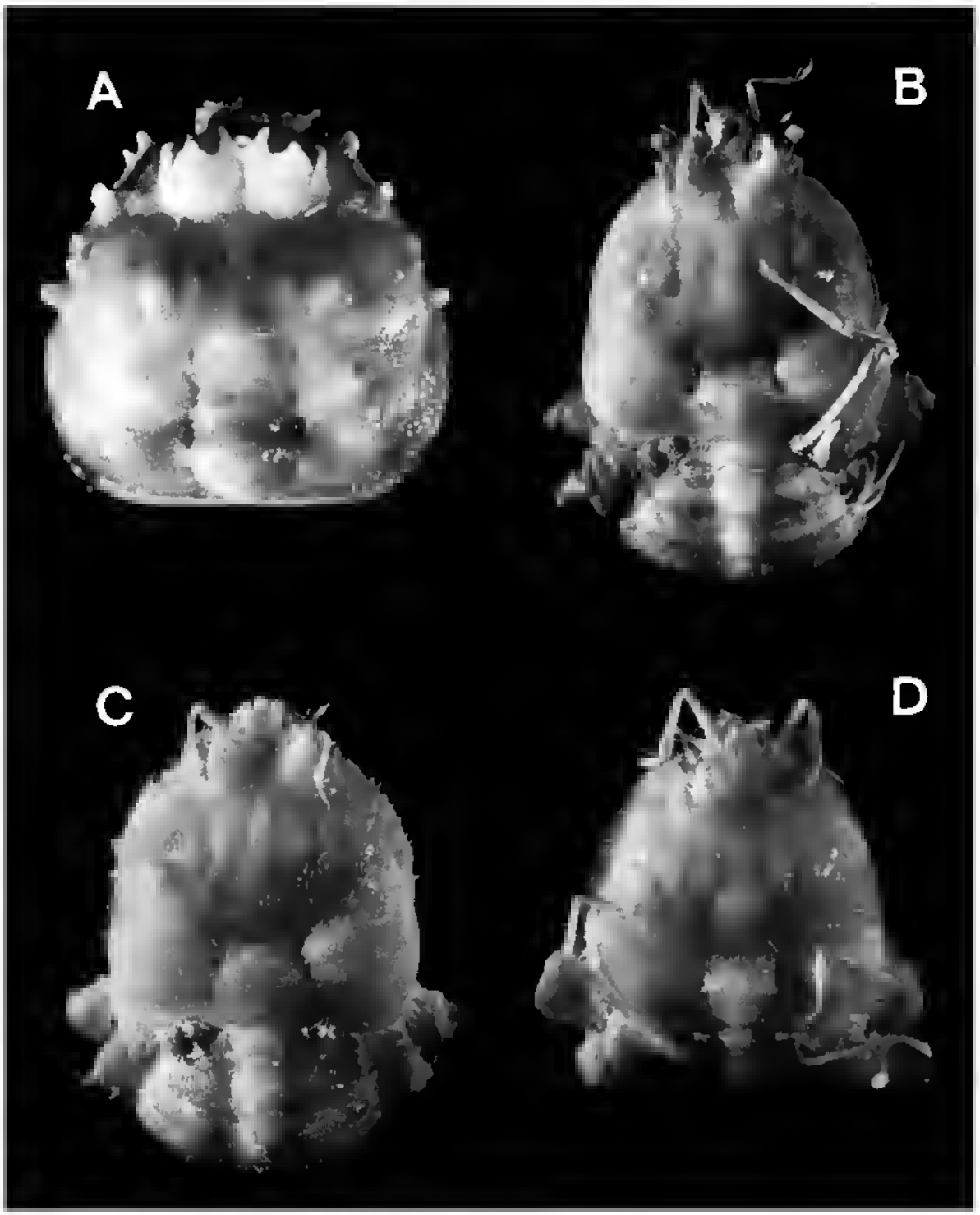

FIG. 9. — Vue d'ensemble de la carapace . A, *Tymolus japonicus* Stimpson, 1858, ♂ 10,4 × 10,3 mm, Hakodate, Japon (USNM 45844); B, *Tymolus uncifer* (Ortmann, 1892), ♂ 0,6 × 0,6 mm, baie de Tosa, île Shikoku (USNM 120712); C, *Tymolus similis* (Grant, 1905), ♂ 9 × 9,5 mm, Crowdy Head, N. S. W. (AMS P. 11742); D, *Tymolus brucei* sp. nov., holotype, ♂ 4 × 5 mm, 18°52,2'S-116°11,1'E (NTM-Cr. 001179)

Source : MNHN, Paris

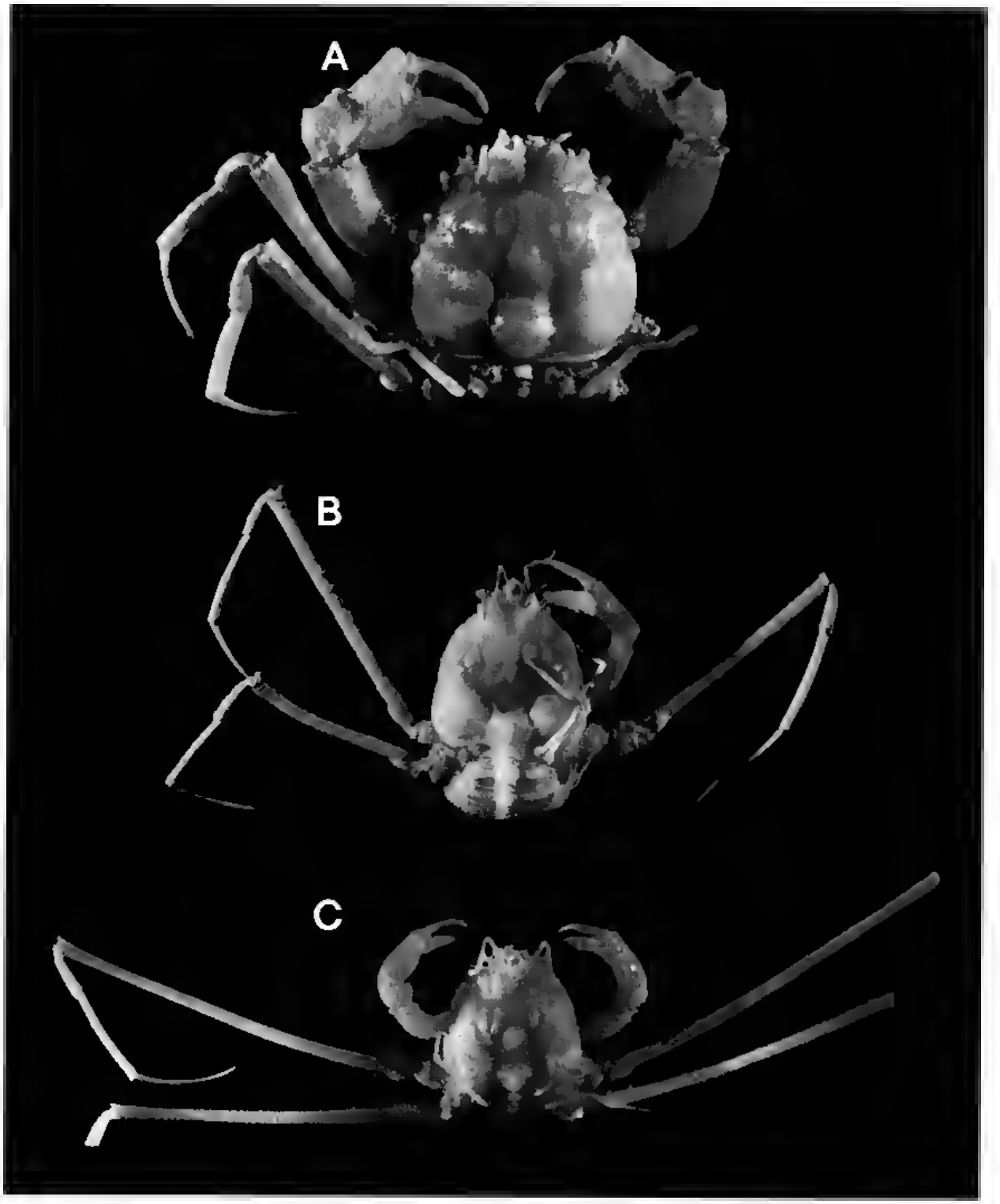

FIG. 10. — Vue d'ensemble : A, *Tymolus japonicus* Stimpson, 1858, ♂ 10,4 × 10,3 mm, Hakodate, Japon (USNM 45844); B, *Tymolus uncifer* (Ortmann, 1892), ♂ 0,6 × 0,6 mm, baie de Tosa, île Shikoku (USNM 120712); C, *Tymolus brucei* sp. nov., holotype, ♂ 4 × 5 mm, 18°52,2' S-116°11,1' E (NTM-Cr. 001179).

Source : MNHN, Paris

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Source : MNHN, Paris

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A small collection of deep water sponge crabs (Brachyura, Dromiidae) from French Polynesia, including a new species of *Sphaerodromia* Alcock, 1899

by Colin L. McLay

Abstract. — This paper reports on a small collection of sponge crabs (Brachyura : Dromiidae) from French Polynesia, mostly collected by the Service Mixte de Contrôle Biologique des Armées (SMCB) during 1984-1990 using baited traps from depths of 100-1120 m. These crabs came from depths between 190-450 m. In addition one specimen came from 3-5 m on a coral reef near Moorea. The collection includes *Cryptodromiopsis tridens* Borradaile, 1903*a*, *Petalomera wilsoni* (Fulton and Grant, 1902), and *Sphaerodromia ducoussoi* sp. nov. With the description of the new species, the opportunity is taken to review the genus *Sphaerodromia* which now contains four species : *S. kendalli* (Alcock and Anderson, 1894), *S. nux* Alcock, 1899*b*, *S. brizops* McLay and Crosnier, 1991, and *S. ducoussoi* sp. nov. *S. lethrinusae* Takeda and Kurata, 1976, does not belong in this genus. The genus *Sphaerodromia* must be considered the most primitive known genus of the Dromiidae and comparison with *Dynomene devaneyi* Takeda, 1977 (Dynomenidae), shows many similarities. The only substantial difference is that *Sphaerodromia* has phyllobranchiate gills while those of *D. devaneyi* are transitional between trichobranchiate and phyllobranchiate. An hypothesis about the nature of the ancestral dromiids is presented. The generic position of each of the other dromiid species from French Polynesia is considered and the need for generic revision of the Dromiidae, employing a wider range of characters, is emphasized. The characters which should be used include : the presence or absence of epipods in the chelipeds and legs, extent of development of the uropod plates on the abdomen, features of the orbit and antenna, male pleopods, the abdominal locking mechanism, female sternal grooves and the development of spines on and around the dactyls of the legs. Indications of how some of the dromiids should be rearranged are given. The new records and species add to the known dromiid fauna of French Polynesia *Cryptodromia canaliculata* Stimpson, 1858 and *C. coronata* Stimpson, 1858 and bring the total to five species. The biogeographic relations of these species are similar to those already identified by Forest and Guinot (1962) for the other French Polynesia Brachyura.

Résumé. — Cet article concerne une petite collection de Dromiidae provenant de la Polynésie française, récoltés pour la plupart par le Service Mixte de Contrôle biologique des Armées (SMCB) qui, entre 1984 et 1990, a effectué de nombreuses pêches au moyen de casiers, à des profondeurs comprises entre 100 et 1120 m. Les crabes étudiés ici ont été récoltés entre 190 et 450 m. Il s'y ajoute un spécimen capturé entre 3 et 5 m sur un récif près de Moorea. La collection comprend *Cryptodromiopsis tridens* Borradaile, 1903, *Petalomera wilsoni* (Fulton et Grant, 1902) et *Sphaerodromia ducoussoi* sp. nov. La description d'une nouvelle espèce de *Sphaerodromia* fournit l'occasion de revoir ce genre qui renferme maintenant quatre espèces : *S. kendalli* (Alcock et Anderson, 1894), *S. nux* Alcock, 1899*b*, *S. brizops* McLay et Crosnier, 1991 et *S. ducoussoi* sp. nov. *S. lethrinusae* Takeda et Kurata, 1976 n'appartient pas à ce genre. Le genre *Sphaerodromia* peut être considéré comme le plus primitif des genres de la famille des Dromiidae et une comparaison avec *Dynomene devaneyi* (Dynomenidae) montre de nombreuses similitudes. La seule différence importante est que *Sphaerodromia* possède des phyllobranchies tandis que *D. devaneyi* présente des branchies intermédiaires entre des trichobranchies et des phyllobranchies. La position générique de chacune des autres espèces de Dromiidae de Polynésie française est examinée et la nécessité d'une révision des Dromiidae, faisant intervenir un éventail plus grand de caractères, est

Source : MNHN, Paris

soulignée. Les caractères qui devraient être pris en considération comprennent : la présence ou l'absence d'épipodes sur les péréiopodes, le développement des lames uropodales, les particularités de l'orbite et de l'antennule, les pléopodes mâles, le mécanisme de blocage de l'abdomen, les sillons sternaux de la femelle et le développement des épines sur et au voisinage des dactyles des péréiopodes. Des indications sur la manière dont certaines espèces de la famille pourraient être reclassées sont fournies. Les récoltes étudiées ici portent à cinq le nombre des espèces connues de la Polynésie française, seules *Cryptodromia canaliculata* Stimpson, 1858, et *C. coronata* Stimpson, 1858, ayant été, auparavant, signalées de cette région. Les relations biogéographiques de ces espèces sont similaires à celles mentionnées par FOREST et GUINOT (1962) pour les autres brachyoures de la Polynésie française.

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INTRODUCTION

This paper reports the occurrence of a small number of dromiid crabs from French Polynesia, including Mururoa, Takapoto, Makemo and Tuanake in the Tuamotu Archipelago, Moorea in the Society Islands and Raevavae in the Austral Islands. The collection includes *Petalomera wilsoni* (Fulton and Grant, 1902), *Cryptodromiopsis tridens* Borradaile, 1903*a*, and a new species of *Sphaerodromia* Alcock, 1899*a*. For the known species these records represent significant extensions of their distribution in the Pacific. Up to the present the only dromiids known from French Polynesia were *Cryptodromia canaliculata* Stimpson, 1858, and *C. coronata* Stimpson, 1858 (FOREST and GUINOT, 1962). The collections were made by C. BOUCHON, Muséum national d'Histoire naturelle, Paris, from Moorea, and by Joseph POUPIN, Service Mixte de Contrôle Biologique des Armées, from the other sites. I am very grateful to both these people for the opportunity to study this material, which has been deposited in the Muséum national d'Histoire naturelle, Paris.

Apart from *Sphaerodromia lethrinusae* Takeda and Kurata, 1976, which should be excluded from this genus (MCLAY and CROSNIER, 1991), there are three other species of *Sphaerodromia* : *S. kendalli* (Alcock and Anderson, 1894), *S. nux* Alcock, 1899*b*, and *S. brizops* McLay and Crosnier, 1991. With the addition of the new species of *Sphaerodromia,* the opportunity is taken to review the relationships between all the species in this genus, and to compare some of the important characters with a species of *Dynomene* (Dynomenidae Ortmann, 1892). This comparison establishes *Sphaerodromia* as the most primitive genus of the Dromiidae and demonstrates the similarity of the species of *Sphaerodromia* to this dynomenid. For the other species in this collection, the important characters are identified and the errors or omissions of earlier workers are clarified.

In this work I indicate the important characters which should be used in subsequent generic revision of the Dromiidae. The dromiid genera have not been revised since BORRADAILE (1903*b*) and with the discovery of many new species, a great deal of confusion has arisen because the genera were defined using a very limited range of, sometimes, vague characters. For this reason, a necessary part of the revision will be accurate redescription of most of the dromiid species. In this paper I use the terms 'chelipeds', and 'legs' to refer to the five pairs of pereiopods. These limbs fall naturally into three groups according to their role : 1) the chelipeds, used for feeding as well as cutting out of pieces of other living organisms for

Source : MNHN, Paris

concealment, 2) the first two pairs of legs, used for walking, and 3) the last two pairs of legs, used for carrying the camouflage over the dorsal surface. The propodi and dactyli of the legs are equipped with thorn-like structures which are referred to as spines, although they are no doubt setal in origin. The antennal articles, which are all mobile, are referred to as 'segments 1-4' : these correspond to coxa (or urinal segment), fused basis-ischium, merus and carpus. A well developed exopod is fused to the second segment and the point of attachment is usually marked by a shallow groove.

Genus **SPHAERODROMIA** Alcock, 1899*a*

Sphaerodromia Alcock, 1899*a* : 16; 1899*b* : 152; 1901 : 38. — Balss, 1922 : 106. — Sakai, 1936*b* : 15.

The following definition is largely based on Alcock (1901) with the addition of information about the male pleopods, the uropods, and clarification of the situation regarding pereiopod epipods and podobranchs.

Carapace sub-globose, front broadly triangular, grooved in the midline, rostrum not developed, continuous with supra-orbital margin. Carapace surface gradually rounded, surface tomentose, as are limbs. Chelipeds longer and stouter than first two pairs of legs, which are not nodose; last two pairs of legs smaller, similar in size, not reaching the ground, but only the last pair is sub-dorsal. Cheliped with an epipod and well developed podobranch, first two pairs of legs also have epipods, with or without podobranchs; gills are phyllobranchiate. Female sternal grooves end wide apart behind the genital openings. First male pleopod with a small, rounded terminal plate, second pleopod simple, needle-like with an exopodite on the basis. Vestigial pleopods are present on male segments 3-5. Uropod plates well developed, visible externally and occluding up to approximately half the sub-terminal abdominal segment from the lateral margins.

Sphaerodromia ducoussoi sp. nov.

(Pl. 1A; figs. 1a-d, 2a-h, 3a-d)

Material. — French Polynesia, Tuamotu Archipelago, Tuanake, stn 253, 16°37.3'S, 144°13.3'W, trap, 450m, 05 June 1990 : 1 ♂ holotype, CW = 43mm, CL = 43.2mm (MNHN-B 22172) (Poecilasmatid cypris stage barnacle on epistome; one juvenile, on right mandibular palp and one adult *Poecilasma* sp. on right mandible). — Mururoa Island, trap, ?400m, 1984 : 1 ♀ paratype, CW = 40.9mm, CL = 41.4mm (MNHN-B 22173).

Types. — Both specimens have been deposited in the Muséum national d'Histoire naturelle, Paris, under the registration numbers MNHN-B 22172 and 22173.

Description

Except where indicated the description is based on the male specimen.

Carapace approximately as wide as long, narrowed anteriorly, broadly convex longitudinally, more strongly convex laterally in the anterior half, surface uniformly finely granulated

Source : MNHN, Paris

with fine, short setae ; H-shaped cardiac grooves curved, terminating posteriorly in cardiac pits which mark the end of faint branchial grooves (more evident near the carapace margins). Rostrum not prominent, bilobed, lateral rostral teeth separated by shallow groove; margin of rostrum extends uninterrupted around the entire supraorbital margin and on to the rounded suborbital lobe which is very prominent in dorsal view; medial corner of suborbital lobe blunty rounded. First segment of antenna beak-like medially, gaping and twisted, surface of second segment convex, distomedial corner not produced, exopod fixed and produced beyond the joint of third and fourth segments, tip truncate and sloping dorsally, ratio of length (i.e. exopod + basis) to width of basis = 2.1. Ratio of antennal flagella to CW = 0.28. Dorsal surface or orbit has a ridge separating off a region which accommodates the corneal region of the eye. Cornea well developed, dark brown, eyestalk carries fine, short setae externally, eye can be totally hidden from dorsal view when folded. Subhepatic region strongly inflated, with scattered larger granules. Anterolateral border of carapace begins near and at the level of the postorbital corner, broadly rounded and divided into three almost equal sections; the first two sections each have 8-9 larger rounded granules and the second notch marks the branchial groove. Posterior carapace margin concave and paralleled by a distinct groove.

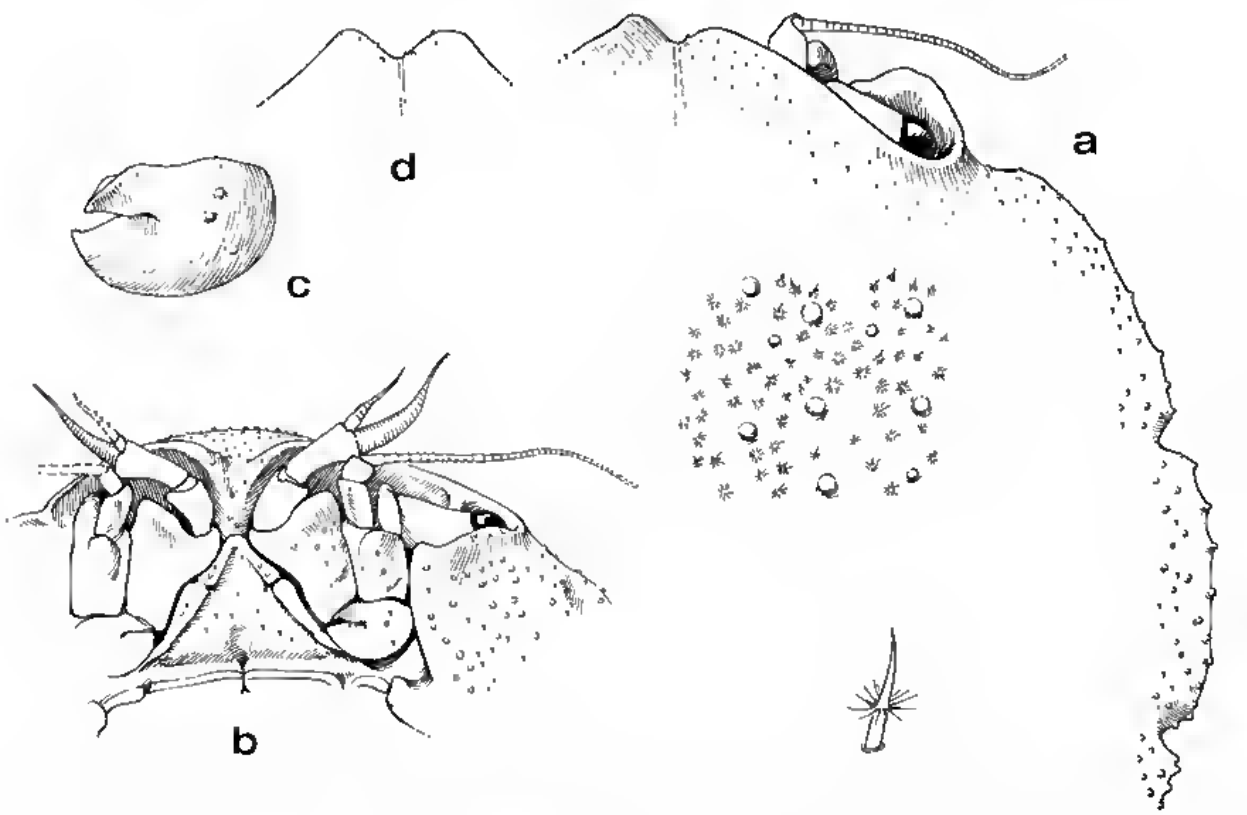

FIG. 1. — *Sphaerodromia ducoussoi* sp. nov., a-c, ♂ holotype 43 × 43.2 mm, Tuamotu Archipelago (MNHN-B 22172) : a, front and right anterolateral margin of carapace, dorsal view, with details of carapace surface and setae ; b, left orbit, ventral view ; c, details of the first segment of antenna. — d, ♀ paratype 40.9 × 41.4 mm, Mururoa Island (MNHN-B 22173), outline of rostrum.

All drawings are at the same scale except for details which are at a higher magnification.

Source : MNHN, Paris

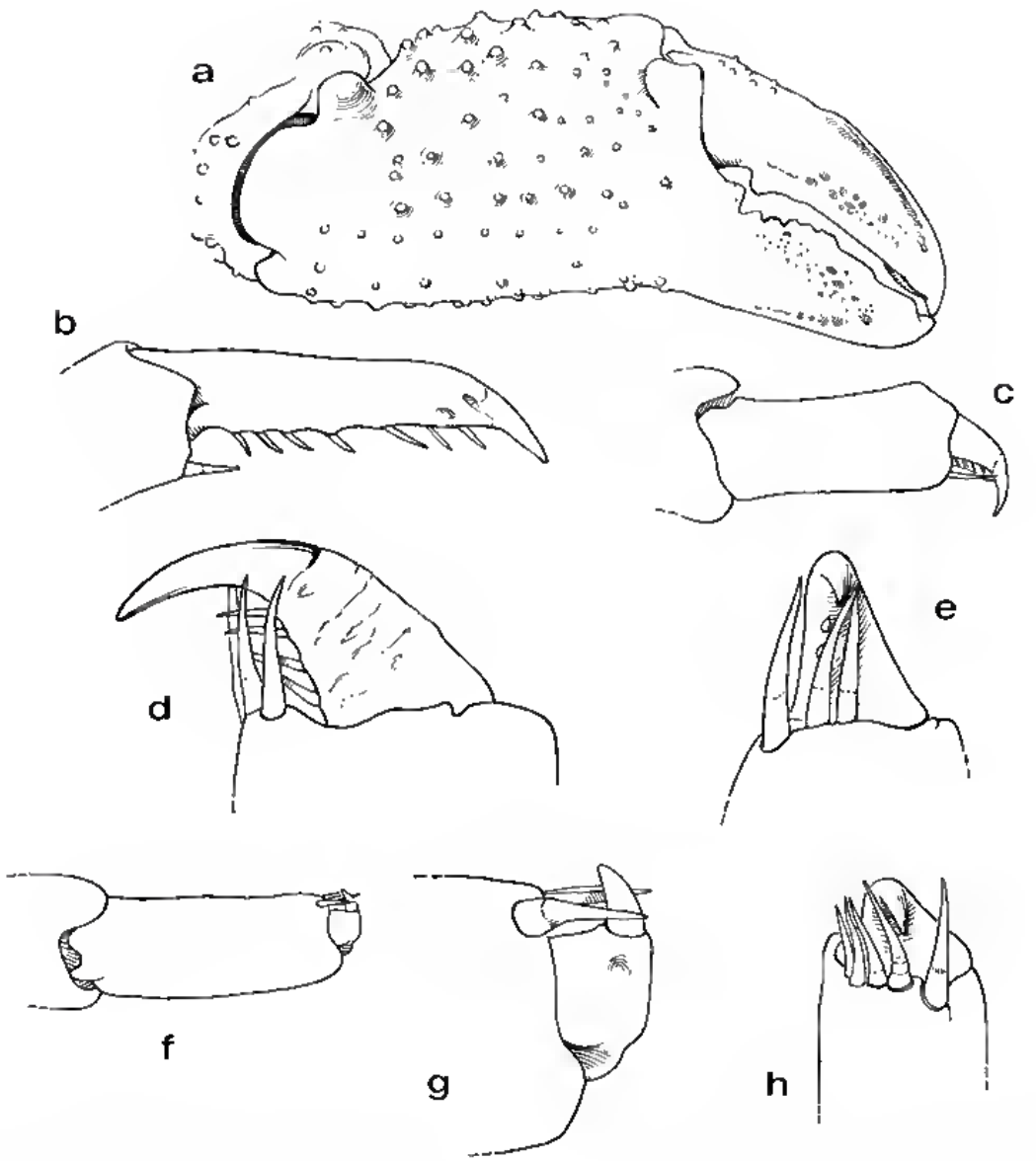

FIG. 2. — *Sphaerodromia ducoussoi* sp. nov., ♂ holotype 43 × 43.2 mm, Tuamotu Archipelago (MNHN-B 22172) : a, right chela, setae omitted; b, dactylus of 2nd right leg, posterior view; c, propodus and dactylus of 3rd right leg, posterior view; d, *idem*, tip, anterior view; e, *idem*, tip, ventral view; f, propodus and dactylus of 4th right leg, posterior view; g, *idem*, tip, posterior view; h, *idem*, tip, dorsal view.

Fig. 2a is at the same scale as in fig. 1; figs 2b, c, and f are at a higher scale; figs 2d, e, g, and h are at an even higher magnification.

Source : MNHN, Paris

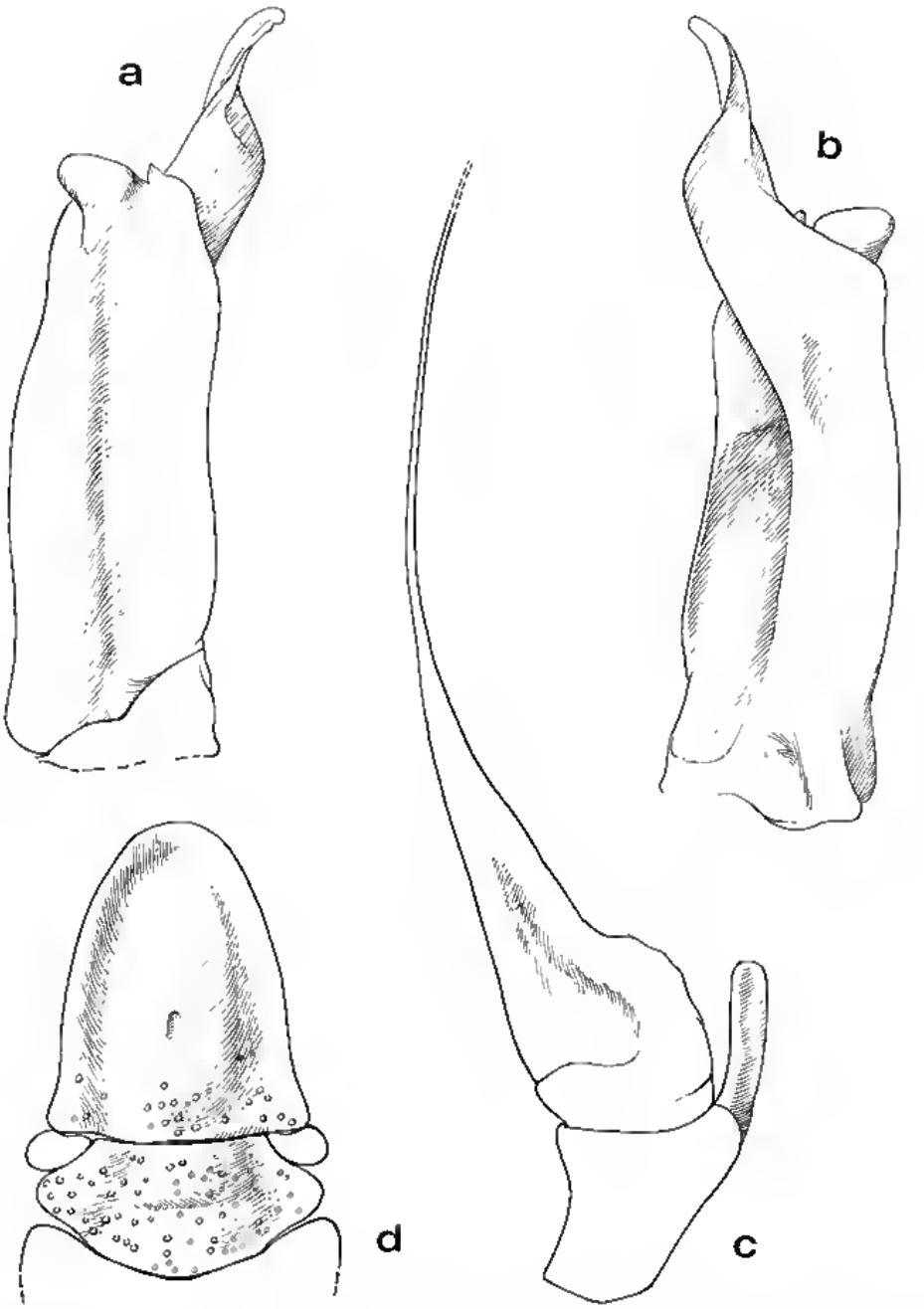

FIG. 3. — *Sphaerodromia ducoussoi* sp. nov., ♂ holotype 43 × 43.2 mm, Tuamotu Archipelago (MNHN-B 22172) : a, left first pleopod, dorsal view, setae omitted; b, *idem*, ventral view; c, left second pleopod, ventral view; d, telson and penultimate abdominal segment with uropods.
All the drawings are the same scale except for fig 3d which is at a lower scale.

Source : MNHN, Paris

All limbs fringed with short, stout setae. Chelipeds well developed with a large epipod bearing a small podobranch (all gills are phyllobranchiate — stacked leaf-like plates). Merus trigonal, inferior surface and margins with scattered rounded granules, outer face of carpus with 16-17 prominent rounded granules, upper half of propodus similarly adorned. Fingers pink-white, stout, hollowed out internally, fixed finger armed with 6 proximal teeth (first largest), moveable finger with a large proximal tooth which engages with teeth on the other finger. Fingers close along most of their length with tips coarsely dentate. Internal face of propodus densely pubescent. First two pairs of legs with epipods, podobranch of first leg very small, absent in second leg. Both legs as long as chelipeds, segments not knobbed, elongate, narrow, scattered small granules, propodi distinctly longer than dactyli (ratio = 1.6), inferior distal corner of propodi armed with a single short spine overlapping with dactyl for a short distance, inner margin of dactyls armed with 6-7 short spines all of similar size. Last two pairs of legs similar to first two pairs except shorter, each about the same length. Dactyl of third leg strongly curved, opposed by 3 short propodal spines and bearing 3 accessory spines on the inner margin; dactyl of fourth leg very short and opposed by 5 small propodal spines, no accessory spines.

Abdomen of 6 free segments, telson longer than wide (although wider than long in the mature female), tip broadly rounded; uropod plates well developed and visible externally, lying between the bases of first and second legs when the abdomen is closed but they are not involved in locking the abdomen. The abdominal locking mechanism consists of finely denticulate ridges on the coxae of leg 1 and leg 2; the coxal ridge of the first leg engages with the margin of the proximal corner of the telson, while the coxal ridge of the second leg engages with the inner face of the joint between the fifth and sixth abdominal segments. Abdominal segments 3-5 of male have vestigial pleopods. Female sternal grooves very weakly developed, ending inconspicuously wide apart behind genital openings. First male pleopod stout, openly grooved to carry needle-like second pair; distal end of endopodite bears a blunt lateral knob and a semi-oval, curved medial plate; basis of second pleopod has a short, blunt exopodite.

Etymology. — The species is named after the head of the S.M.C.B., R. Ducousso who encourages research on the deep-sea fauna of French Polynesia and who provided some funds for the illustration of this paper.

Discussion

Of the four species in this genus, *Sphaerodromia ducoussoi* sp. nov. most closely resembles *S. nux* (Alcock, 1899*b*), but differs in the following ways : sub-orbital margin produced as a prominent rounded lobe (not so prominent in *S. nux*), anterolateral margin divided into three granulated sections (continuous and granulated in *S. nux*), length/width ratio of antennal basis = 2.1 (1.6 in *S. nux*), ratio of antennal flagella to CW only 0.28 (0.42 in *S. nux*), ratio of propodi/dactyli of first two pairs of legs = 1.6 (1.3 in *S. nux*), and accessory spines on inner margins of dactyli of last pair of legs absent (present in *S. nux*). Furthermore the podobranchs of *S. ducoussoi* are different : the cheliped epipod is large with a well developed podobranch and podobranch on second leg is absent (as in *S. nux*) but the podobranch on first leg is very small (absent in *S. nux*). *S. nux* is known only from the type locality, Gulf of Martaban,

Source : MNHN, Paris

Burma, from Madagascar and Seychelles and Reunion Island, all localities in the Indian Ocean.

The only genus of the Dromiidae which has received detailed attention is *Dromia* Weber, 1795; FOREST (1974) made a comparative study of all known species of this genus thereby defining the limits of variation which might be expected within a genus of this family. This paper provides a model which should guide future work on the genera of the Dromiidae. The important characters of the species of *Sphaerodromia* are shown in table 1 which also includes *Dynomene devaneyi* Takeda, 1977 for comparison. Firstly, the following characters are shared by the species of *Sphaerodromia* : they all have a rounded, unornamented carapace with at the most a few small granules on the anterolateral margins, an antennal exopod extending beyond the joint of segments 3-4, bluntly rounded tip and fitting closely against base of eyestalk, distomedial corner of second segment of antenna not produced, epipods are present on the chelipeds and first two pairs of legs, a podobranch is present on the chelipeds (and sometimes the legs) all gills are phyllobranchiate, stacked leaf-like plates, vestigial pleopods are present on male abdominal segments 3-5, the male abdominal locking mechanism involves serrated ridges on the coxae of the first two pairs of legs, the first male pleopods have an apical plate and simple blunt tip, the second male pleopods are needle-like and with an exopodite on the basis, male uropods are well developed and not involved in the abdominal locking mechanism (although the male of *S. kendalli* is unknown, it seems likely to share these features), the female sternal grooves end apart behind the base of the second walking leg (although the female of *S. brizops* is unknown it is likely to be similar), and the dactyl spines on the last two pairs of legs are similar in arrangement and number. In addition, all the *Sphaerodromia* spp. have propodi longer than dactyli on the first two pairs of legs (it should be noted that this ratio increases with crab size and all the ratios in the table are for mature animals).

TABLE 1. — Comparison of important characters for *Sphaerodromia* spp. and *Dynomene devaneyi*. Reference should be made to the text for explanation of each character.

SPECIES	*D. devaneyi*	*S. brizops*	*S. kendalli*	*S. ducoussoi*	*S. nux*
Orbital ridge	weak, vertical	strong, horizontal	strong, vertical	weak, vertical	strong, vertical
Anterolateral teeth	3	13-15 granules	0	0	appr. 15 granules
Distomedial extension of 2nd antennal segment	none	none	none	none	none
Male uropods	large	small	?	small	small
Male PL1	apical plate	apical plate	?	apical plate	apical plate
Exopod on male PL2	present	present	?	present	present
Male PL3-PL5	present	present	?	present	present
Ending of sternal grooves	apart, behind leg 2	?	apart, behind leg 2	apart, behind leg 2	apart, behind leg 2
Presence of epipods	chela + leg 1 + leg 2	chela + leg 1 + leg 2	chela + leg 1 + leg 2	chela + leg 1 + leg 2	chela + leg 1 + leg 2
Size of podobranchs	large + sm. + sm.	large + sm. + sm.	large + sm. + sm.	large + sm. + abs.	large + sm. + abs.
Leg 1 dactyl spines	0+0+3	1+0+8	0+0+6	1+0+7	1+0+6
Leg 2 dactyl spines	0+0+3	1+0+8	0+0+6	1+0+7	1+0+7
Leg 3 dactyl spines	0+0+3	3+0+2	3+0+3	3+0+3	3+0+3
Leg 4 dactyl spines	1+0+0	4+0+4	3+0+3	5+0+0	4+0+3
Legs 1 & 2 coxal ridges	none + none	serr. + serr.	?	serr. + serr.	serr. + serr.
Legs 1 & 2 propod' dactyl	1.0	1.3	1.3	1.6	1.3

PL = pleopod; sm = small; abs. = absent; serr. = serrated; the formula for dactyl spine on legs 1-4 (i + j + k), where i = number of propodal spines opposing the dactyl, j = number of spines on the outer propodal margin, and k = number of spines on the inner margin of the dactyl, i.e. accessory spines.

Source : MNHN, Paris

Secondly, there is some variation in the construction of the orbit, especially in *S. brizops*, in the dactyl spines of the first two pairs of legs and in the development of the podobranchs. *S. kendalli* has no distal propodal spine at the base of the dactyl of the first two pairs of legs which must be regarded as an advanced feature. It seems that a key feature of crabs of the family Dromiidae is the presence of spines opposed to the dactyl and which can be used to form a sub-chelate mechanism on the last two pairs of legs for grasping pieces of camouflage. Although the propodal spines on the first two pairs of legs are still present, they are not, for obvious reasons, functional, and have been lost in *S. kendalli*. Also we can see in any one species of *Sphaerodromia* the gradual reduction of spines on the inner margin of the dactyl from the first to the last leg (see fig, 2b-h). This is accompanied by shortening of the propodus, curving of the dactylus, and increase in the number of spines opposing the dactyl. In more advanced dromiids there are no propodal spines on the first two pairs of legs (spines on the inner margins of the dactyls are retained) and there are only rarely any spines on the inner margins of the dactyls of the last two pairs of legs. Thus the hypothesis that I am presenting is that the ancestral dromiid had four legs, used for walking, each similar to the first or second leg of *S. ducoussoi* (see fig. 2b) with strong dactyls carrying numerous spines on the inner margin and with one or more distal propodal spines overlapping the base of the dactyl. From this one can derive any of the spine arrangements seen in other dromiids whether they are used for grasping sponges, ascidians or shells. Since many of these characters are seen in the Homolodromiidae [see for e.g. *Dicranodromia baffini* (Alcock and Anderson, 1899), *Homolodromia robertsi* Garth, 1973, also Baez and Martin, 1989] the dromiid to which I am referring may have been ancestral to the homolodromiids as well. In both of these families the last two pairs of legs are similarly modified for carrying camouflage. Guinot (1978) has suggested that an important difference between the homolodromiids and dromiids is that the former are facultative carriers of camouflage whereas the latter are obligatory carriers (see also Baez and Martin, 1989). The homolodromiids appear to have all the necessary morphological equipment for carrying, but perhaps they do not have the behaviour well established. In this way, the homolodromiids would represent an intermediate stage in the evolution of camouflage-carrying.

The podobranchs of *Sphaerodromia* also show a gradual reduction : in *S. brizops* and *S. kendalli* the cheliped podobranch is large, while those on the legs are progressively smaller, and further stages are seen in *S. ducoussoi* where the podobranch on the second leg is absent and again in *S. nux* where the first two pairs of legs have no podobranchs at all. Despite this variation, these species form a natural generic group and they mark an early stage in the evolution of the Dromiidae. Podobranchs are absent from all other known species in this family : cheliped epipods are found in *Hemisphaerodromia, Dromia* and *Dromidiopsis* for e.g. but pereiopodal epipods are absent in *Pseudodromia, Dromidia*, and *Cryptodromia.*

It is useful to compare the *Sphaerodromia* spp. with a species of the Dynomenidae e.g. *Dynomene devaneyi*. There are some remarkable similarities : in *D. devaneyi* the front of the carapace is rounded, the second segment of the antenna and exopod are very similar to *Sphaerodromia*, a supraorbital ridge is present, the male pleopods are identical with *Sphaerodromia* and the female sternal grooves are also the same. But epipods are present on chelipeds and the first two legs and the podobranchs are well developed on all these pereiopods, suggesting a more primitive stage than in *Sphaerodromia*. A major point of difference is that *D. devaneyi* has what appear superficially to be trichobranchiate gills, rather

Source : MNHN, Paris

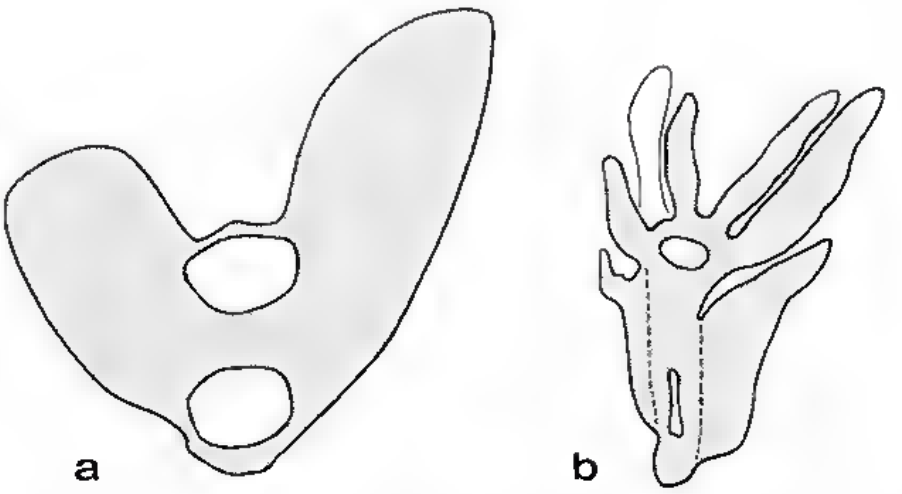

FIG. 4. — Section through arthrobranch of left second leg : a, *Sphaerodromia nux* Alcock, 1899*b*; b, *Dynomene devaneyi* Takeda, 1977. In both drawings the gill plate is filled and blood channels are open. In 4b the filaments are arranged in rows except that the open gill plate indicates that its position alternates with the plate to the right The scale for fig. 4b is 1.4 × scale for 4a.

than phyllobranchs (see fig. 4a, b), but it is unclear whether this should be regarded as a primitive feature. The dichotomy between trichobranchiate and phyllobranchiate gills is extremely arbitrary and it does not recognise the existence of a great variety of structure among so-called " trichobranchiate " gills (M. DE SAINT LAURENT, pers. comm.). The gills of *D. devaneyi* are best described as transitional and it should be noted that even within the Dynomenidae there are phyllobranchiate-like gills in *D. filholi* and essentially phyllobranchiate gills in *Acanthodromia erinacea* (see BOUVIER, 1894). This further reduces any real differences between dynomenids and dromiids.

The abdominal locking mechanism in *D. devaneyi* is different from all the *Sphaerodromia* spp. Although the male uropods in *D. devaneyi* are a large, they are not used in locking the abdomen : this is achieved by the abdominal flap fitting loosely under blunt teeth on the posterior coxal margins of the first two legs. In *S. ducoussoi*, for e.g., the abdomen is grasped laterally by small, angled, serrated ridges on the coxae of these legs. In neither of these crabs do the uropods play any part in locking the abdomen but the mechanism for retaining the abdomen is quite different, being a simple catch mechanism in *D. devaneyi* and a more elaborate grasping mechanism in *S. ducoussoi* and other species of this genus.

However, *D. devaneyi* does have distinct anterolateral teeth and no distal propodal spines on any of its legs; the " spine " opposing the dactyl on the last legs is really an extension of the border of the propodus (like the fixed finger of the cheliped) and probably not homologous with the spines on *Sphaerodromia*, and besides, the dactyl on this limb is very reduced so that the grasping mechanism is obsolete. Thus there are some features of *D. devaneyi* which would suggest that the dynomenids may be ancestral to the dromiids, but they perhaps have some advanced features as well. The whole question of the origin of the dromiids and whether the dynomenids should really be a separate family must await a more detailed study of the other species of the Dynomenidae because they are a poorly known group. Particular attention should be paid to the details of the structure of the gills.

Source : MNHN, Paris

Cryptodromiopsis tridens Borradaile, 1903*b*
(Fig. 5a-d)

Cryptodromiopsis tridens Borradaile, 1903*a* : 229; 1903*b* : 578, pl. 33, fig. 4. — Ihle, 1913 : 91 (list). — Edmondson, 1922 : 39, pl. 2A, B, C; 1946 : 268. — Ward, 1934 : 6. — Buitendijk, 1950 : 62. — Tweedie, 1950 : 106. — Eldredge, 1977 : 249, fig. 1. — Lewinsohn, 1984 : 113.
Dromidia fenestrata Lewinsohn, 1979 : 3, fig. 1a-j.

Material. — French Polynesia, Society Islands, Moorea, 17°30′S, 149°50′W (approx. locality), slope of outer reef, on side of a fissure in *Distichopora* sp. (Hydrozoa, Milleporina), 3-5 m, 28 August 1979 : 1 ♂ CW = 7.5, CL = 6.2 mm.

Additional material examined. — Society Islands, Tahiti, no locality or date known, coll. A. Garret, Museum Godeffroy, 2 ♂♂, 1 ♀, with a compound ascidian (*Distaplia*? *taylori*), catalogue no. K-05000. Kindly loaned by Dr. G. Hartmann, Zoologisches Museum, Universitat Hamburg.

Description

Carapace wider than long, smooth, convex, covered in a short tomentum except for two sharply circumscribed naked areas near the posterolateral corners which are marked by deep grooves; faint cardiac grooves extend forward medially from these areas, branchial grooves not evident. Rostrum tridentate all three teeth relatively slender and acute with the median tooth on a slightly lower level and extending further forward. A shallow frontal groove extends back between a pair of low protuberances. Eroded orbital margin extends back from the lateral rostral tooth, not concealing antennal base and point of insertion of flagella, to a distinct supraorbital tooth, followed by a longer but less acute postorbital tooth which has a small tubercle at its base. No fissure at the postorbital corner, infraorbital margin is eroded laterally and has a single acute tooth. The first segment of the antenna is very reduced, inner margin only slightly beak-like, second segment is large and flattened with the distolateral corner produced as a spine and the distomedial corner produced as a longer spine on which the third antennal segment is inserted at an angle. The antennal exopod is curved to accommodate the laterally directed antennae and rests against the base of the eyestalk and the under-surface of the orbital margin (thereby dividing the orbit into two compartments) when closed. Ratio of length/width of basis = 2.14; ratio of antennal flagella to CW = 0.52; ratio of exopod/(basis + exopod) = 0.33. The subhepatic area is convex and bears one acute tooth which is visible dorsally; also a distinct buccal tooth. Collectively the two tubercles on the second antennal segment and the infraorbital and subhepatic teeth give appearence of a row of four teeth sloping laterally. The anterolateral margin begins at the level of the orbit, rounded and has two acute teeth, the first of which longer is than the second and is just above the subhepatic tooth. There is no posterolateral tooth and the posterolateral carapace borders are convergent. Posterior margin of carapace is slightly sinuous.

Chelipeds and legs covered in a short soft tomentum. Chelipeds moderately developed, fingers strongly down-curved and white, carpus with two strong distal tubercles and central area of outer face inflated. Superior propodal margin has 3-4 small rounded granules. Fingers

Source : MNHN, Paris

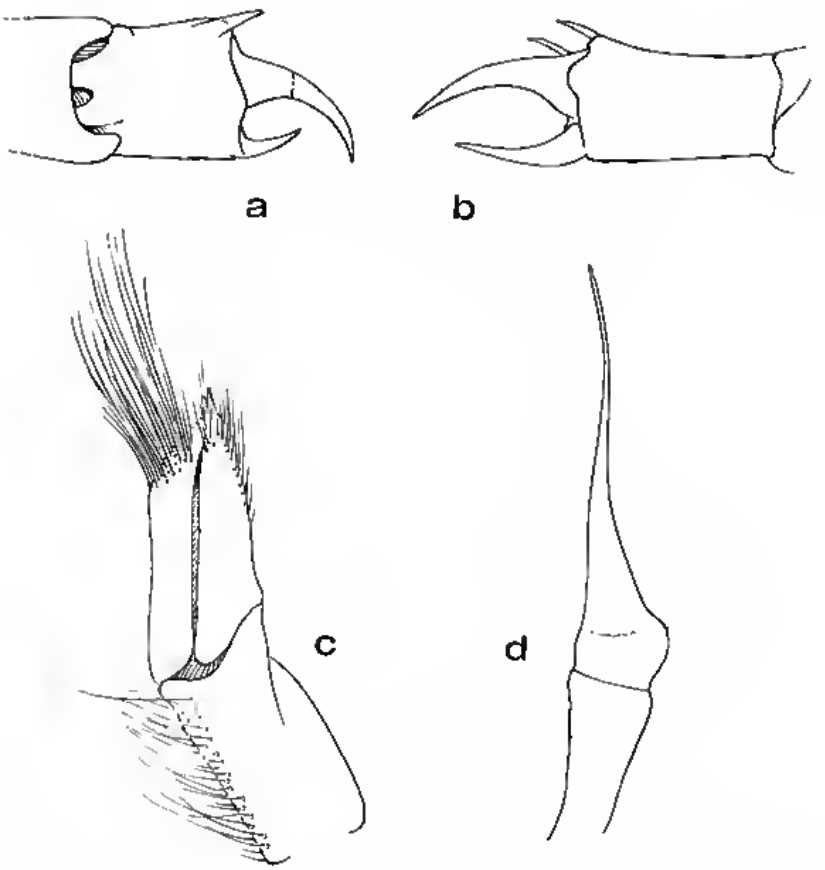

FIG. 5. — *Cryptodromiopsis tridens* Borradaile, 1903*b*, Society Islands, Moorea, ♂ 7.5 × 6.2 mm : a, propodus and dactyl of right 3rd leg, posterior view; b, propodus and dactyl of right 4th leg, posterior view; c, left first male pleopod, dorsal view; d, left second male pleopod, dorsal view.
The scale for figs. 5a, b is the same; figs. 5c, d are at a higher magnification.

in male gaping; one or two interlocking distal teeth and 4-5 smaller proximal teeth; in the female the fingers are regularly toothed and close over their entire length. First two pairs of legs shorter than chelipeds, upper margin of carpi strongly produced, as acute tubercles, dactyli short and stout, with 4-5 small spines along the inner margin, propodi of similar length. Last two pairs of legs shorter than the first two pairs, the third pair shortest, dactyl opposed by a single propodal spine with another stout spine on the outer margin. Dactyl of last leg also opposed by a single spine with another spine on the outer margin of the propodus and an additional spine on the outer margin of the dactyl itself.

Telson wider than long and rounded: uropod plates visible externally, and the abdomen has a strong median ridge. Abdominal locking mechanism involves uropod plates sitting in front of serrated ridge on the base of the first leg. Female sternal grooves end close together in a median tubercle between the chelipeds. Male first pleopod a simple folded tube with a setose apex armed with a sharp tubercle; second pleopod needle-like.

Source : MNHN, Paris

Discussion

These new records of *Cryptodromiopsis tridens* from Moorea in the Society Islands extend the range further westward from Hawaii (Edmondson, 1922). The species was originally described from Male and Minitoki atolls in the Maldives (Borradaile, 1903*b*) and subsequently reported from Christmas Island (Ward, 1934), Gesira, Somalia (Lewinsohn, 1979) and Madagascar (Lewinsohn, 1984) in the Indian Ocean. Further records from Cocos Keeling and Singapore (Tweedie, 1950; Buitendijk, 1950) and from Ifalik atoll (Caroline Islands), Midway Island and various Hawaiian Islands were summarized by Eldredge (1977). *C. tridens* is clearly a very widespread Indo-Pacific species restricted to tropical waters. The very distinctive circumscribed, naked areas on the posterolateral corners of the carapace make it unlikely that misidentification could have occurred.

Three of the French Polynesia specimens were accompanied by pieces of camouflage, two with sponges and one with a compound ascidian. Eldredge (1977) found that the majority (70 %) of the specimens which he examined carried didemnid ascidians, primarily species of *Didemnum*, while the others carried various species of sponge. Edmondson (1946) found that *C. tridens* was common near shore, under stones and in rock crevices, and usually carried light brown sponges. This predominant use of ascidians is the reverse of *Cryptodromia hilgendorfi*, which in Moreton Bay, Queensland, Australia, carries mainly sponges (McLay, 1983). Therefore there may be some specialisation amongst dromiids in their use of different kinds of camouflage. *C. tridens* is amongst the smallest dromiid crabs with the maximum recorded sizes being ♂ CW = 9.2, CL = 8.0, ♀ CW = 8.0, CL = 6.0 mm, smallest ovigerous ♀ CW = 6.4, CL = 5.2 mm.

Borradaile (1903*a*) erected the genus *Cryptodromiopsis* for *C. tridens* and he gave the following definition for the genus : " Dromiidae with no epipodite on the cheliped, the walking legs knobbed or ridged, the carapace broader than long, especially broad in the forepart, and with the furrows between the regions almost completely lost, the ridges of the efferent branchial channels well made, the sternal grooves of the female ending together on the cheliped segment, the fifth leg shorter than the third, and a spine on the outer side of its last joint ". It should be noted that while the female sternal grooves extend to the level of the bases of the chelipeds, they are not in fact associated with the cheliped segment : the end of these grooves mark the suture between segments 7/8 of the thorax (see Hartnoll, 1975). The aim was to separate from *Cryptodromia*, a species with convergent sternal grooves, but there is nothing especially distinctive about these characters or their combination and Borradaile clearly did not regard the unusual carapace features as being worthy of generic status. Subsequently, three other species have been added to *Cryptodromiopsis* : *C. bituberculatus* (Stebbing, 1920) (originally placed in *Eudromia* by Stebbing and later in *Cryptodromiopsis* by Barnard, 1947), *C. lepidota* Barnard, 1947, and *C. mortenseni* Kensley, 1978. Barnard also included *Dromidia spongiosa* Stimpson, 1858 in *Cryptodromiopsis* but it is quite different.

These species do not make a natural group, having very little in common with each other. *C. tridens* shows some similarities (no epipod on cheliped, well developed uropods, relatively long last legs, spines on outer propodal margins of last two pairs of legs and sometimes accessory spines as well, sternal grooves end together between chelipeds) to some species of

Source : MNHN, Paris

Cryptodromia (*C. bullifera* Alcock, 1899*b*, *C. mariae* Ihle, 1913) and also to species of *Dromidia* [*D. antillensis* Stimpson, 1858, *D. larraburei* Rathbun, 1910, *D. plumosa* (Lewinsohn, 1984)]. [It should be explained that *Dromidiopsis plumosa* Lewinsohn, 1984 does not belong in this genus; an examination of the type specimen shows that LEWINSOHN was mistaken in stating that there is an epipodite on the cheliped. Thus the species should be *Dromidia plumosa* (Lewinsohn, 1984)]. However, moving *C. tridens* to either of these genera would remove the type species from *Cryptodromiopsis* and leave three species with little in common with the original concept of the genus. For the present it seems preferable to leave *C. tridens* where it currently is and to relocate the other species : *C. bituberculatus* should probably be returned to a re-defined *Eudromidia* and a new genus created for *C. lepidota* and *C. mortenseni* which are reasonably similar to each other. This will be undertaken in a later paper with the result that the genus *Cryptodromiopsis* will no longer be necessary. The need for generic revision of the Dromiidae has been noted by several authors (e.g. LEWINSHON, 1984) and the need is nowhere more glaringly obvious than in *Cryptodromiopsis*.

LEWINSOHN (1979) illustrated the last two pairs of legs of specimens from Somalia but the text description does not agree with his figure 1. Later, LEWINSOHN (1984) stated that the illustrations were in fact correct and the text in error, but close examination of specimens of *C. tridens* shows that on neither occasion was LEWINSOHN correct : the third leg has one propodal spine opposing the dactyl and another on the outer margin at the base of the dactyl, and the fourth leg has, in addition to these spines, a small accessory spine on the outer margin of the dactyl itself.

Petalomera wilsoni (Fulton and Grant, 1902)
(Pl. 1B; figs 6a-d, 7a-c, 8a-c)

Cryptodromia lateralis : HELLER, 1865 : 71. — MIERS, 1876 : 57. — THOMSON, 1899 : 170, pl. 20, figs. 1, 2. — CHILTON, 1911 : 49. Not Gray, 1831.
Cryptodromia wilsoni Fulton and Grant, 1902 : 61, pl. 9. — IHLE, 1913 : 91 (list).
Dromia pseudogibbosa : PARISI, 1915 : 102, pl. 2, figs. 1, 2. — BALSS, 1922 : 106. — YOKOYA, 1933 : 97.
Petalomera lateralis : RICHARDSON, 1949 : 60, fig. 51. Not Gray, 1831.
Petalomera wilsoni : RATHBUN, 1923 : 154, pl. 42, fig. 1. — HALE, 1927 : 113, fig. 111. — SAKAI, 1936*a* : 33, pl. 1, fig. 1; 1936*b* : 34, pl. 1, fig. 4, text fig. 9; 1965 : 9, pl. 4, fig.2; 1976 : 24, pl. 6, fig. 1. — BARNARD, 1947 : 368; 1950 : 313, fig. 59e. — GUILER, 1952 : 37. — DELL, 1963 : 22. — BENNETT, 1964 : 27, fig. 141. — SUZUKI and KURATA, 1967 : 95 (list). — DELL, 1968 : 14, pl. 2. — KIM, 1970 : 9 pl. 1, fig. 3; 1973 : 608. — WEAR, 1979 : 1; 1977 : 572. — GRIFFIN, 1972 : 56. — KENSLEY, 1978 : 251; 1981 : 37 (list). — KIM and KIM, 1982 : 136. — MIYAKE, 1983 : 6, pl. 3, fig. 1. — BABA, *in* BABA, HAYASHI and TORIYAMA, 1986 : 309, pl. 162

MATERIAL. — French Polynesia, SMCB coll. : Tuamotu Archipelago, Takapoto, 14°40,0' S, 145°15,2' W, trap, 250 m, 07 June 1989 : 1 ♂ CW = 61, CL = 41.6 mm. [*Poecilasma* sp. (Cirripedia : Poecilasmatidae) on carapace and merus of one walking leg.]; Makemo, stn 308, 16°34,5' S, 143°39,9' W, trap, 280 m, 07 October, 1990 : 1 ♂ CW = 61.0, CL = 45.4 mm. — Tubuai Islands, Raevavae, 23°51,4' S, 147°44,5' W, trap, 350 m, 01 March 1989 : 5 ♂♂ CW = 44.0, 50.6, 45.8, 48.9, 48.5, CL = 32.0, 36.2, 34.0 34.2, 34.8 mm resp. ; 3 ♀♀ CW = 42.8, 36.5, 38.6, CL = 33.8, 26.9, 29.4 mm resp. — Marquesas Islands, Tahuata, stn 300, 9°54,5' S, 139°07,9' W, trap, 190 m, 01 September 1990 : 2 ♀♀ ovig. CW = 46.5, 44.6, CL = 32.9, 33.7 mm resp.

Source : MNHN, Paris

DESCRIPTION

Carapace distinctly wider than long, moderately convex, surface smooth, gently undulating, under a thick cover of soft, long hairs which give the surface an areolate appearance. Cardiac and branchial grooves well marked by depressions, a pair of medial cardiac pits and another single one further back. Median rostral tooth small, blunt and on a lower level, projecting as far forward as lateral rostral teeth which are separated by a U-shaped sinus, from which extends a distinct frontal groove separating two rounded protuberances. Lateral rostral teeth continuous with the supraorbital margin, which has a broad, blunt

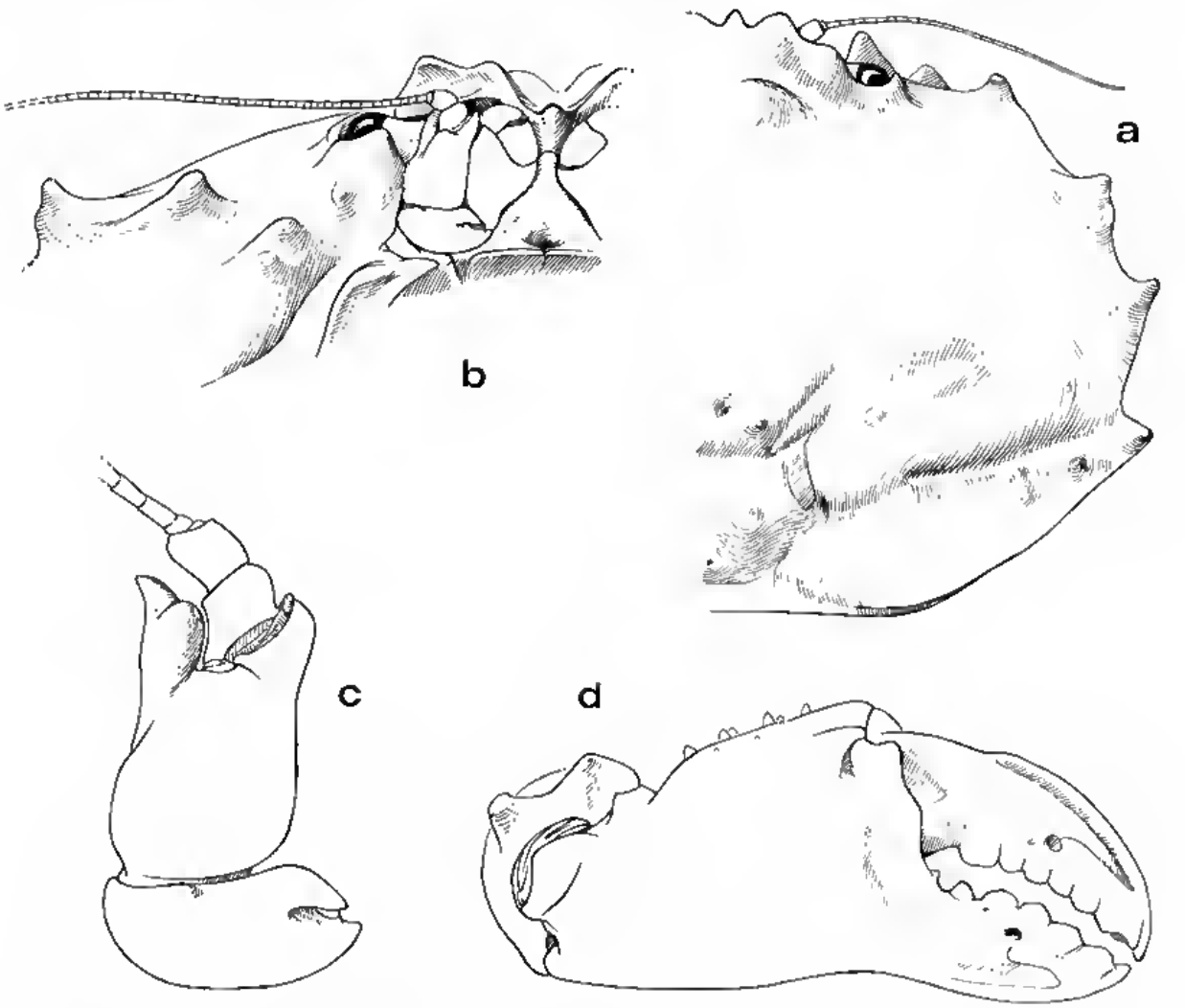

FIG. 6. — *Petalomera wilsoni* (Fulton and Grant, 1902), Tubuai Islands, Raevavae, ♂ 48.5 × 34.8 mm : a, right half of carapace, dorsal view; b, right orbit and anterolateral margin, ventral view; c, basal segments of right antennae, ventrolateral view; d, right cheliped, outer face.

The scale for figs. 6a, d is the same; fig. 6b is 1.25 times 6a and 6c is at a higher magnification.

Source : MNHN, Paris

supraorbital tooth. External orbital corner not produced and with a small fissure separating it from the strong infraorbital tooth, which is visible dorsally. First segment of antenna medially beak-like, gaping, and twisted, second segment convex, with flange-like lateral margin, rounded tubercle at base of third segment, distomedial corner produced, curved; exopod fused to second segment, produced beyond third segment, tip bilobed, inner lobe acute and curved over base of eyestalk; ratio of length to width of second segment = 1.3, ratio of antennal flagella to CW = 0.43. In the dorsal part of the orbit, beneath the supraorbital margin, there is the vestige of a parallel ridge and at the lateral end of the ridge it meets a weak vertical ridge (an extension of the supraorbital tooth), which tends to divide off a corneal region of the orbit. Subhepatic area of carapace convex with a small, blunt tubercle beneath the infraorbital tooth and another, larger tubercle lower and between it and the first anterolateral tooth. A well marked groove, beginning below the orbit, curves under the larger subhepatic tubercle and anterolateral margin and terminates near the posterolateral tooth. Three strong anterolateral teeth extend back from the level of the infraorbital tooth; first tooth directed forward and the last two upwardly directed. [Both FULTON and GRANT, 1902 and RATHBUN, 1923, stated that there are 4 anterolateral teeth, but the first tooth is clearly subhepatic in position.] Posterolateral tooth, large, also projects upward; on the ridge behind the branchial groove there is a small tubercle close to the base of the posterolateral tooth; posterolateral margins convergent and posterior margin of carapace is concave.

Chelipeds bearing an epipodite, large, especially in male, merus triangular in section, all three borders have small rounded granules, carpus has 2 large distal nodules, inner angle has a sharp tooth; propodus smooth, upper border in male sparsely covered in rounded nodules, in female these nodules are rudimentary. Inner and outer surfaces of fingers longitudinally grooved and covered with tomentum, distal surface alone is naked and glabrous. Fingers pink, hollowed internally, armed with 7 well developed teeth and gaping when closed, long silky hairs on inner surface of propodus and fingers. First two pairs of legs shorter than chelipeds,

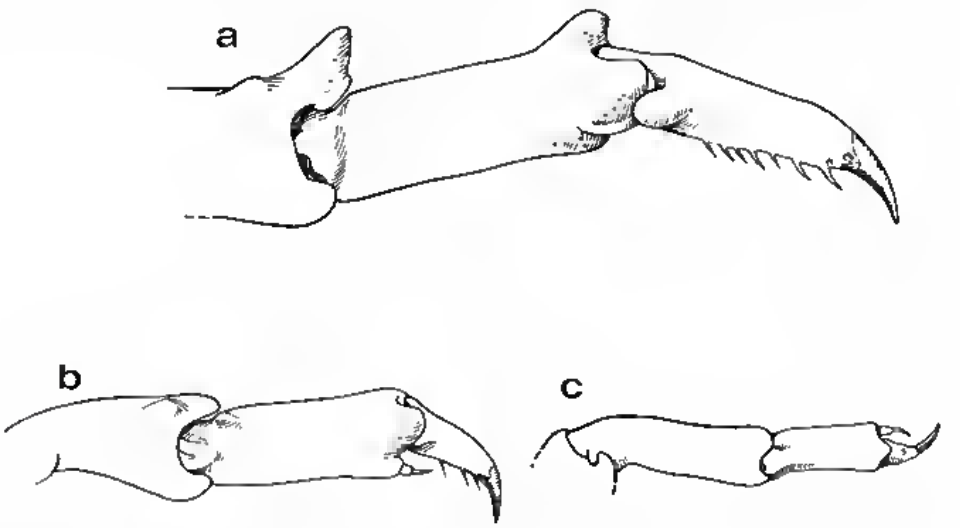

FIG. 7. — *Petalomera wilsoni* (Fulton and Grant, 1902), Tubuai Islands, Raevavae, ♂ 48.5 × 34.8 mm : a, propodus and dactyl of right second leg, posterior view; b, propodus and dactyl of right third leg, posterior view; c, propodus and dactyl of right fourth leg, posterior view.
All drawings are all at the same scale.

Source : MNHN, Paris

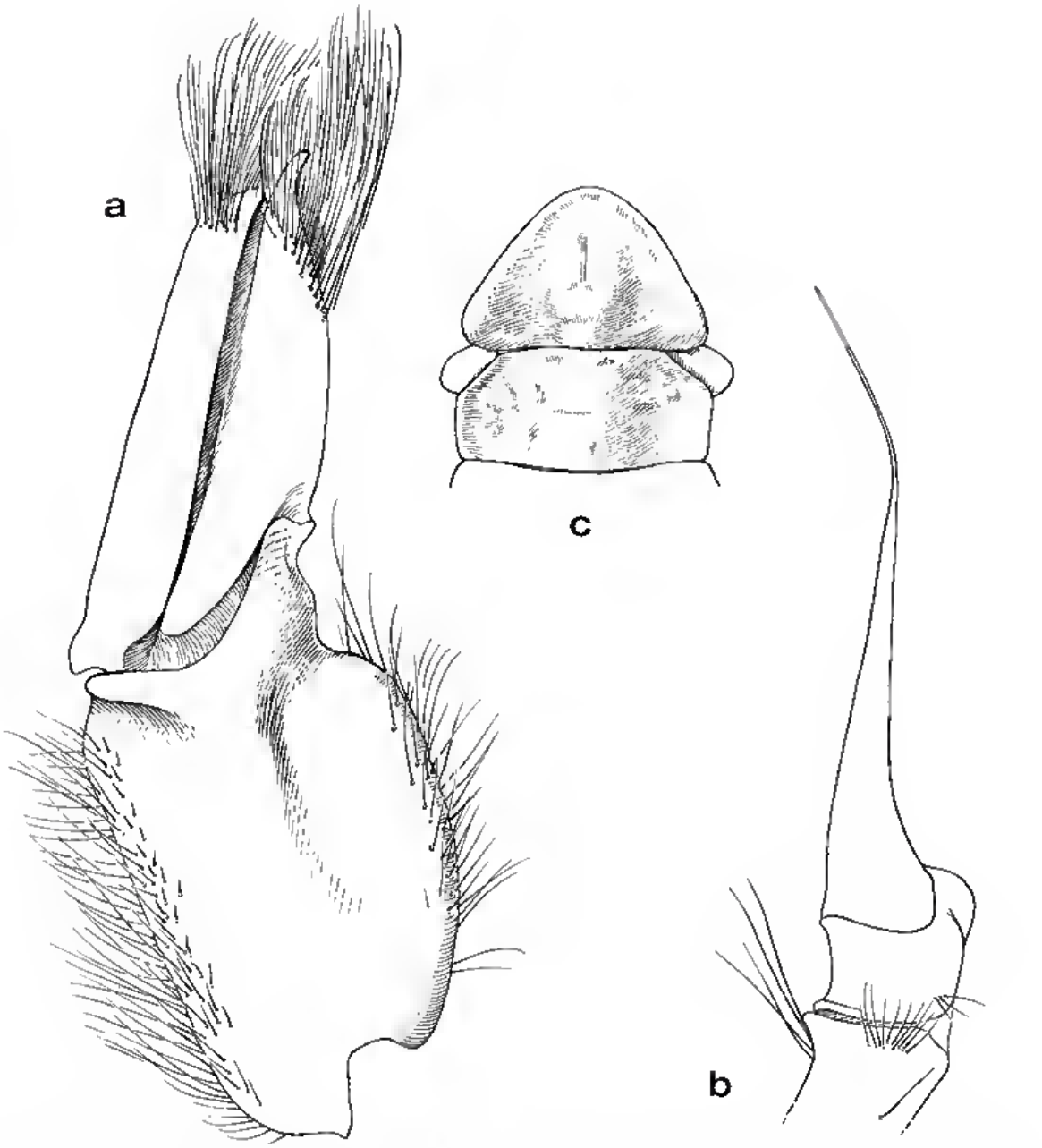

FIG. 8. — *Petalomera wilsoni* (Fulton and Grant, 1902), Tubuai Islands, Raevavae, ♂ 48.5 × 34.8 mm : a, left first pleopod, dorsal view; b, left second pleopod, dorsal view; c, telson and penultimate segment of abdomen with uropods.

The scale for figs. 8a, b is the same; fig. 8c is at a lower magnification.

Source : MNHN, Paris

first slightly longer than second, carpi and propodi have tuberculiform nodules at distal ends of anterior borders, dactyli approximately as long as propodi, inner margins of dactyls have 5-7 small spines which increase in size distally. Last two pairs of legs much reduced and of similar size, with a single propodal spine opposing the curved dactyl on each leg, but inner margin of dactyl of third leg has 3-4 small accessory spines.

Abdomen of six free segments, telson much wider than long, male telson trigonal (ratio = 1.5), female telson subtruncate (ratio = 1.7). Uropod plates well developed and visible externally; abdominal locking mechanism involves uropods fitting in front of well developed serrated flanges on the base of the first legs. Male first pleopod is a partially rolled tube with a densely setose, broadly rounded tip armed with a sharp horny tubercle, second pleopod simple and needle-like. Female sternal grooves end wide apart on small raised tubercles between bases of first and second legs.

Discussion

At present there are some 17 species in the genus *Petalomera* Stimpson, 1858 and the definition of the genus is currently as follows : " Dromiidae with an epipodite on the chelipeds, the walking legs bearing sharp ridges, the carapace varying in the relation of its length to its breath, but usually broader than long, the regions clearly or indistinctly marked, the efferent branchial channels well made, the sternal grooves of the female ending apart behind the cheliped segment, the fifth leg shorter than the third, and without a thorn on the outer side of its last joint." (Borradaile, 1903*b*). (The same remarks should be made here in relation to Borradaile's use of the term 'cheliped segment' as were made about the definition of the genus *Cryptodromiopsis*, see earlier.) The type species of *Petalomera* is *P. granulata* Stimpson, 1858 which has as its most distinctive feature, the petaloid meri on the chelipeds and first two pairs of legs. The only other species which fits this generic concept is *P. pulchra* Miers, 1884 (and its synonym *P. longipes* Ihle, 1913). The problem with this genus is that while the petaloid meri of the type species are not included in the generic definition, these are in fact the only distinctive features and all the other characters mentioned are so vague that almost anything could be put in *Petalomera*, as long as a cheliped epipodite was present and the female sternal grooves were in accordance. Both Alcock (1899*b*) and Barnard (1950) included the petaloid meri character in the definition of the genus, but did not allow the absence of such meri to exclude some species. Alcock also included a granular carapace as being a feature of *Petalomera*, a character which the type species possesses. It seems to me that species in this genus should have at least these three characters : petaloid meri, sternal grooves ending apart behind chelipeds, and a granular carapace (as well as the cheliped epipodite). This means that all the other 15 or so species, not already mentioned (including *P. wilsoni*), should be placed in several new genera.

P. wilsoni has a superficial resemblance to some species of the Dynomenidae, e.g. *Dynomene devaneyi* Takeda, 1977, but differs in several major characters; it has a closer resemblance to *Platydromia depressa* Brocchi, 1875, in terms of its size, shape and shaggy tomentum but differs in having an epipodite on the cheliped and having well-developed uropods; therefore it cannot be placed in *Platydromia*. Many of the important characters of these species of *Petalomera* have not been accurately recorded and so it would be premature to

Source : MNHN, Paris

attempt a generic reorganization at this time. For the present the name of *P. wilsoni* should remain unchanged. It is interesting to note that the two unusual features of the orbit (horizontal and vertical ridges) are found together in *P. wilsoni*, where they are weakly developed or perhaps vestigial. Such features are found separately in species of *Sphaerodromia* and *D. devaneyi* (see table 1) but, as yet, not together. I do not think that this indicates a close relationship.

P. wilsoni was first described from Port Phillip Heads, Melbourne, Australia but it has perhaps the widest distribution of any dromiid crab, including the coasts of Australia from southern Western Australia round to New South Wales, as well as Tasmania. Its southernmost limit is off the Kaikoura coast, South Island, New Zealand (42°24′ S, McLay, 1988). In the Indian Ocean *P. wilsoni* is known from the east coast of South Africa and even extending to St. Helena (15°58′ S, 5°43′ W) in the Atlantic Ocean (Forest, 1974). Within the Pacific it is known as far north as Sagami Bay, Japan. The present records from French Polynesia are important because they extend the distribution of *P. wilsoni* westward to the Tubuai Islands, 147°44,5′ W. Therefore the distribution includes all three of the world's major oceans as well as both sides of equator in the Pacific.

In the present collection two females, taken at the same time from the Marquesas Islands (Tahuata) were ovigerous : CW = 46.5 mm, approx. 3300 eggs, diam. = 0.7 mm, CW = 44.6 mm, approx. 3500 eggs, diam. = 0.65 mm, both broods had small eyespots. Ovigerous *P. wilsoni* females from other localities have been collected from December to June (McLay, 1988) so the occurrence of females with eggs at an advanced stage of development in September indicates a different reproductive schedule in Polynesian waters. Also the eggs are somewhat smaller than reported for New Zealand examples (0.75-1.0 mm). *P. wilsoni* has 3 or possibly 4 zoeal stages (Wear, 1970, 1977; Wear and Fielder, 1985), and although the reproductive strategy does not appear to be directed at producing large numbers of offspring (compared to other crabs of similar size) it is evidently successful in achieving an extraordinarily wide distribution.

None of the *P. wilsoni* specimens from French Polynesia were carrying pieces of camouflage; all were fairly large specimens who entered baited traps and the absence of sponge caps supports the hypothesis of Dell (1968) that larger *P. wilsoni* do not usually carry camouflage materials. Small (CW < approx. 15 mm) specimens which I have examined certainly do carry a tightly fitting cap of sponge or an ascidan but this habit may be lost by older crabs. The very shaggy tomentum may be sufficient concealment for these animals. One specimen from Takapoto had *Poecilasma* sp. stalked barnacles on its carapace and one leg and these would be unlikely to occur if the crab had been carrying a sponge cap. Baba *in* Baba, Hayashi and Toriyama (1986) provide a photograph of a large female *P. wilsoni* from the Kyushu-Palau Ridge (520 m) very heavily covered with stalked barnacles and it was not recorded as having a sponge cap.

The specimens from Polynesia are the largest known for *P. wilsoni*, especially the ♂ CW = 61.0 mm and ♀ CW = 42.8 mm (although this crab is smaller than the CW = 49.1 mm recorded by Baba *in* Baba, Hayashi and Toriyama, 1986), Also the depths at which the specimens were taken, 190-350 m are amongst the deepest known for this species (maximum 520 m) which has usually been collected from depths less than 100 m. It appears that the use of traps to capture crabs from deeper waters may well cause us to revise many of the estimates that we have for the vertical distribution of crabs.

Source : MNHN, Paris

GENERAL DISCUSSION

The only dromiid crabs known from French Polynesia are *Cryptodromia canaliculata* Stimpson, 1858 and *C. coronata* Stimpson, 1858. HOLTHUIS (1953) recorded *C. canaliculata* from Homohomo Island, Raroia Atoll, under rocks near the shore and NOBILI (1907) recorded *C. coronata* from Rikitea on *Halimeda* (Chlorophyta, Codiacene). All three species reported in this paper are therefore new records and they bring the total to 5 species. The fauna may be compared with that of Hawaii where EDMONDSON (1922) recorded *Cryptodromiopsis tridens, Dromidia unidentata* (Ruppel, 1830), taken from blocks of dead coral in shallow water on Waikiki reef, *D. hirsutissima* (Lamarck, 1818) and *Dromidiopsis dormia* (Linnaeus, 1763), reported as *Dromia rumphii* Fabricius, 1798 by LENZ (1901) and EDMONDSON. The record of *D. hirsutissima* should be ignored because it was based only on DANA (1852) who mis-identified *D. dormia* (see RATHBUN, 1923*b*; LEWINSOHN, 1984). EDMONDSON (1946) stated that *D. dormia* occurred sub-tidally and sometimes carried unusual pieces of camouflage : in one case a hollowed out block of wood, and in another case, an old shoe sole ! Thus there is a similar small number of species (3 compared to 5) but only one species in common with French Polynesia. Given the wide distribution of *D. unidentata* and *D. dormia* it is likely that they also will be found in French Polynesia.

In their biogeographic analysis of the French Polynesia Brachyura from shallow water (mostly coral-inhabiting) FOREST and GUINOT (1962) recognized an Indo-West Pacific group which included some very widespread species. Amongst these species were three groups : 1) species endemic to the Pacific; 2) species which extend westward as far as the Indo-Malaysian region (as far as the north-east Indian Ocean), and most importantly; 3) species which extend further west to the coast of Africa and the Red Sea (many of which were absent from the coast of India). Of the dromiids now known from French Polynesia *S. ducoussoi* belongs in the first group, only one species (*C. coronata*) belongs in the second group and the other three (*C. canaliculata, P. wilsoni* and *C. tridens*) all belong to the third group. Thus the small number of dromiids mirrors the general characteristics of the brachyuran fauna as a whole. Species of the genus *Sphaerodromia* live in deeper water than species of the other genera and so have not been sampled as extensively, but it is likely that this genus will also prove to have a similar wide distribution though the individual species may be more restricted.

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Source : MNHN, Paris

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PLATE I

A — *Sphaerodromia ducoussoi* sp. nov., ♂ holotype 43 × 43.2 mm, Tuamotu Archipelago (MNHN-B 22172) : dorsal view of whole crab.

B — *Petalomera wilsoni* (Fulton and Grant, 1902), ♂ 48.5 × 34.8 mm, Tubuai Islands, Raevavae : dorsal view of whole crab, right half of carapace cleared of hairs.

Source : MNHN, Paris

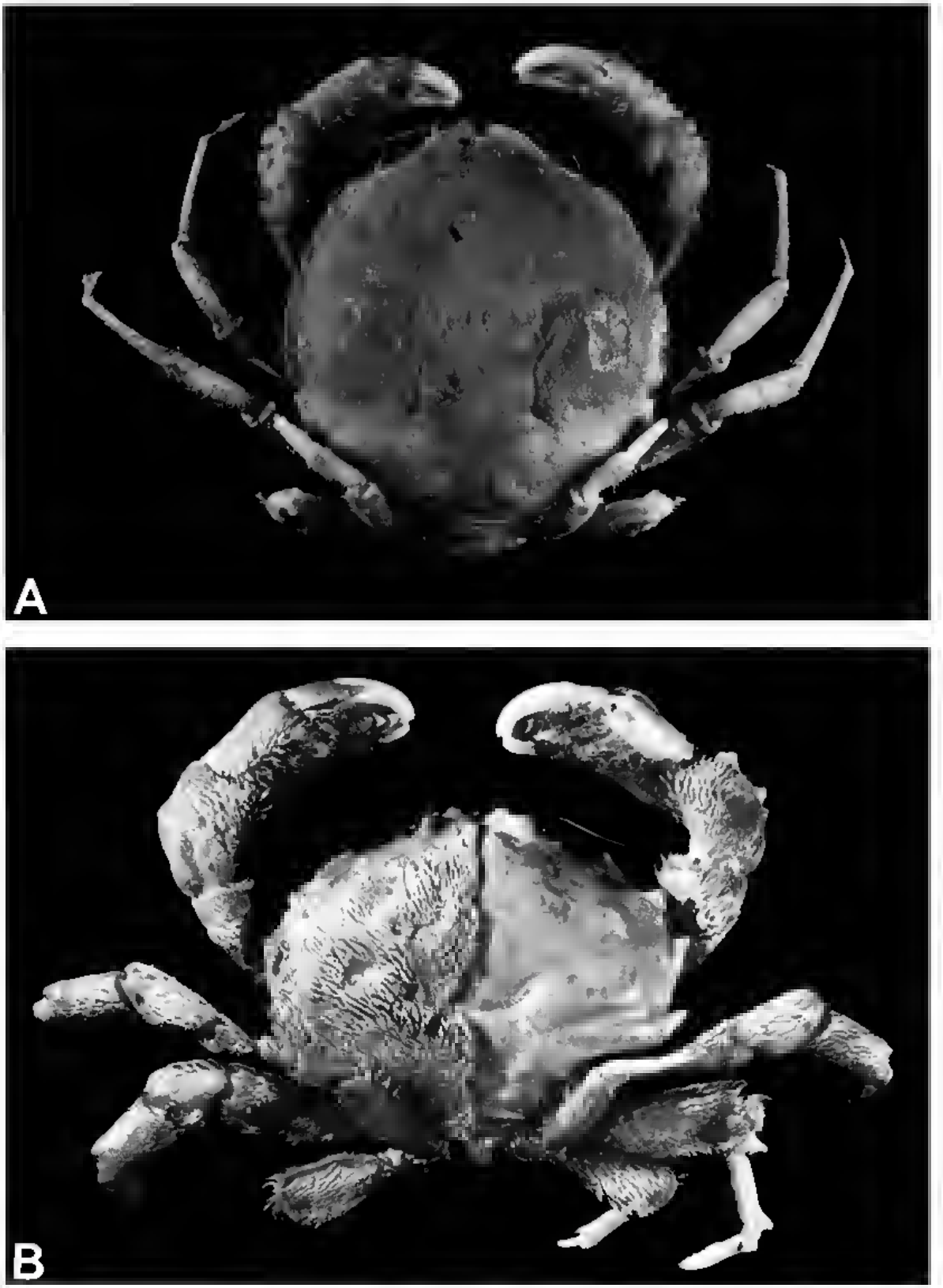

PLATE I

Source : MNHN, Paris

Source : MNHN, Paris

Bull. Mus. natl. Hist. nat., Paris, 4e sér., **13**, 1991,
section A, nos 3-4 : 483.

Replacement name for *Aaroniella badonelli* Thornton (Psocoptera, Philotarsidae)

par Ian W. B. THORNTON *

In describing a species of *Aaroniella* Mockford from Moorea, I inadvertently used a specific name that was preoccupied. A new name is therefore needed for the species from Moorea to replace the junior homonym.

The details are :

Aaroniella andrei nom. nov.

Replacement for *Aaroniella badonelli* Thornton, 1989, *Bull. Mus. natl. Hist. nat.*, Paris. 4e sér., **11**, 1989, section A, no. 4 : 810-812. Preoccupied by *Aaroniella badonelli* (Danks) : DANKS, L. (1950), State Museum of Natural History, Riga, Latvian Soviet Republic, Information Sheet No. I, 2 pp. Transferred to *Aaroniella* by THORNTON, I. W. B. (1981), *Systematic Entomology*, **6** : 425, 432.

The new name retains the purpose of the preoccupied one : to acknowledge the great debt that I, along with other students of the Psocoptera, owe to the late André BADONNEL in the study of this order of insects.

There are also two printing errors in THORNTON (1989) : the generic names *Lepidopsocus* (p. 793) and *Peripsocus* (p. 799) are misprinted.

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Source : MNHN, Paris

Le comité de rédaction du Bulletin du Muséum *remercie les spécialistes qui ont bien voulu prêter leur concours pour le choix et l'examen critique des manuscrits reçus pour publication dans la section A au cours de l'année 1991 :*

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Les articles doivent être adressés directement au Sécrétariat du *Bulletin du Muséum national d'Histoire naturelle*, 57, rue Cuvier, 75005 Paris. Ils seront accompagnés : de la traduction du titre en anglais, d'un résumé en français et en anglais, de l'adresse du Laboratoire dans lequel le travail a été effectué (en note infrapaginale sur la première page).

Le *texte* doit être dactylographié à double interligne, avec une marge suffisante, recto seulement. Pas de mots en majuscules, pas de soulignages (à l'exception des noms de genres et d'espèces soulignés d'un trait). Il convient de numéroter les *tableaux* et de leur donner un titre ; les tableaux importants et complexes devront être préparés de façon à pouvoir être clichés comme des figures.

La liste des *références bibliographiques*, à la fin de l'article, devra être présentée par ordre alphabétique des noms d'auteurs, chaque référence étant indiquée ainsi : auteur, initiales du (ou des) prénom, date, titre d'article ou d'ouvrage (en entier), revue abrégée selon la *World list of Scientific Periodicals*, tome (souligné), numéro (entre parenthèses), deux points, pagination et illustrations.

Les *dessins et cartes* doivent être réalisés à l'encre de chine. Les *photographies* seront le plus nettes possible et tirées sur papier brillant. Tenir compte de la justification du Bulletin : 14,5 cm × 19 cm. L'auteur devra indiquer l'emplacement des figures dans la marge de son manuscrit. Les légendes seront regroupées à la fin du texte sur un feuillet séparé.

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